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ABSTRACT

This report provides an analysis of Missouri's system of higher education within the context of the state's economic development. Section I provides an overview of the changed context of economic competition in terms of global economy, changes in technology, demands for a skilled work force capable of lifelong learning, and changing demographics. Section II demonstrates the necessity of a quality teacher corps for economic development in the course of an overview of the United States and selected nations' performance on some factors of education. Topics include student performance on measures of science and mathematics, postsecondary enrollment and graduation distributions in science and engineering, and a discussion of increasing enrollment in America's postsecondary science and engineering programs. Section III discusses the role of colleges and universities in economic development with reference to research and analysis, capacity building, provision of technical assistance, technology transfer, and new business development. Also described in this section are past, current and future studies and reports by the Coordinating Board. A comparative analysis of some factors of higher education related to economic development for Missouri and 10 of its competitor states is presented in Section IV. A total of 27 tables and figures illustrate the report's findings. (18 references) (JB)

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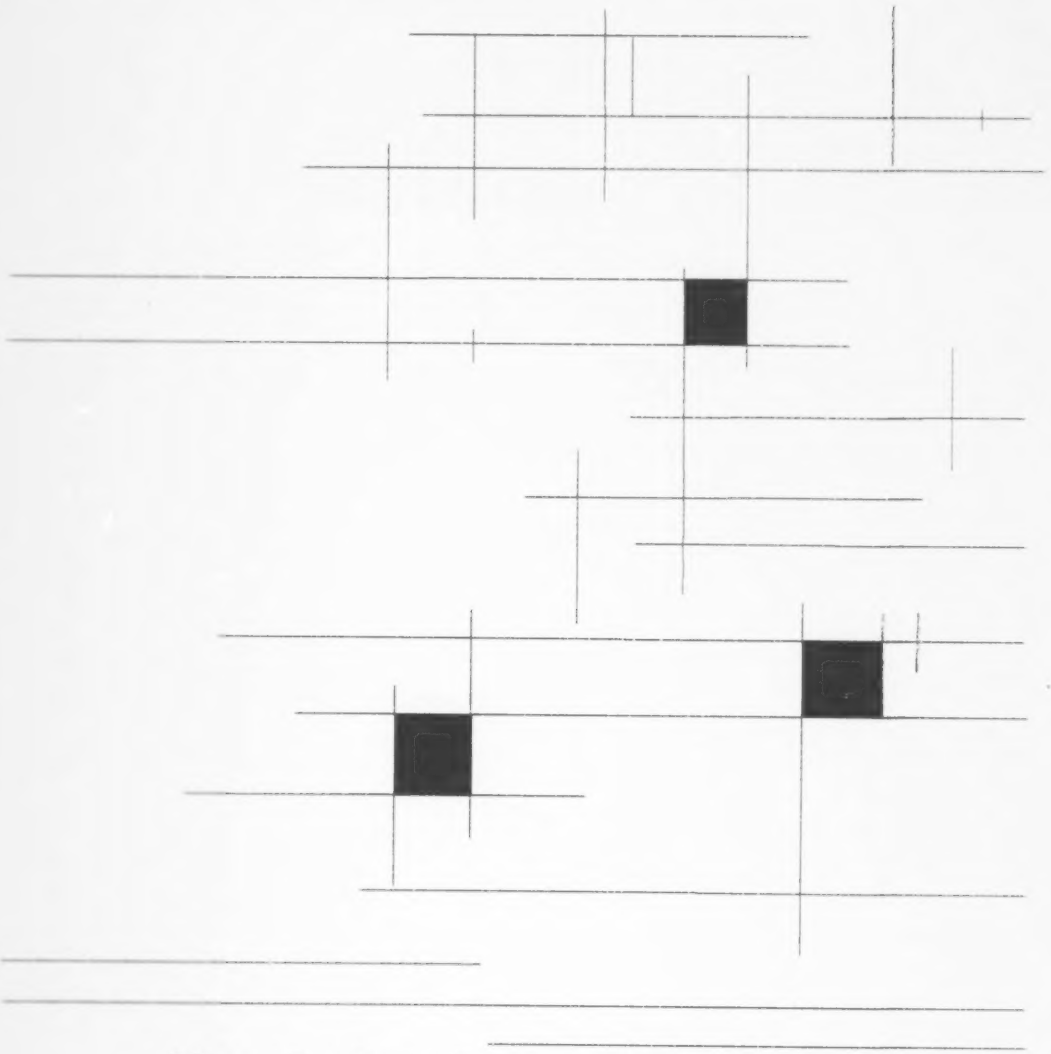

Missouri Coordinating Board for Higher Education
May 1990

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Charles J. McClain
Commissioner of Higher Education
State of Missouri

Missouri Higher Education and Economic Development:

Stimulating and Abetting Insightful Action

Missouri Coordinating Board for Higher Education
May 1990

Professional Staff Responsible for Report:

John R. Wittstruck, Associate Commissioner for
Policy Analysis and Data Services

Robert J. Hess, Research Associate

Coordinating Board for Higher Education
101 Adams Street
Jefferson City, Missouri 65101

Foreword

Increased economic competition among states and with other nations has focused greater attention than ever before on factors related to economic development. Indeed, the varied initiatives and demands on the system of higher education to provide leadership and support for the local, state and national economic development agenda is creating both new opportunities and new challenges for American and Missouri higher education. *Missouri Higher Education and Economic Development: Stimulating and Abetting Insightful Action* provides an overview of the issues and describes the variety of roles higher education has in support of the state's economic development agenda.

The internationalization of the economy and subsequent global competition, the rapid changes in technology and attendant demands for a skilled workforce adaptable to changes in the workplace and capable of lifelong learning, and the changing demographics present emerging challenges to state-level higher education policy planning and development and to higher education institutions. As part of a series of reports to the Coordinating Board for Higher Education, *Missouri Higher Education and Economic Development: Stimulating and Abetting Insightful Action* provides an overview of issues and background on a topical subject of interest and concern to the Board and to the citizens of Missouri. Other reports in this series include *Manpower Trends and Issues: A National Perspective, A Missouri Context;* as well as *Challenges and Opportunities: Minorities in Missouri Higher Education,* the *Invisible Campus: Off-campus and Out-of-district Instruction in Missouri;* and *Report on Student Financial Aid in Missouri.* In addition, reports describing needs for off-campus and out-of-district instruction in three regions of the state have been completed.

Individually these reports present information and background on the policy and planning issues associated with the Board's public policy goals. Collectively, the reports provide an overall context within which the Board plans, coordinates, and establishes policy for creating an environment which enables Missouri's colleges and universities to improve continually their instruction, research and public service.

Charles J. McClain
Jefferson City
May 1990

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Executive Summary

Increased competition among states and with other nations has focused greater attention on factors related to economic development and has fostered an increased awareness by higher education leaders and other officials of the potential the system of higher education has for contributing to the economic vitality of the state. Indeed, a major public policy issue today is the role of higher education in economic development.

Higher education's role in economic development must be viewed in the context of the major transformations now occurring in American society: the shift from an industrial-based to a service – and high technology-based society and the emergence of a highly competitive, international economy. Historically, American higher education has been responsive to the many and varied demands placed upon it by its constituencies and has always had an essential role in stimulating insightful action in periods of change.

Owing to the potential for significant contributions of higher education to the state's economic agenda, this report describes issues, roles, and analyses related to Missouri's system of higher education within the context of the state's economic development.

The Section I of the report provides an overview of the changed context of economic competition. The emergence of a global economy, rapid changes in technology and the attendant demands for a skilled workforce adaptable to changes in the work place and capable of lifelong learning, and changing demographics combine to produce unique challenges for the nation and those states competing for new jobs and economic growth.

Section II of the report demonstrates the necessity of a quality teacher corps for economic development by providing an overview of the United States and selected nations' performance on some factors of education including student performance on measures of science and mathematics achievement, postsecondary enrollment and graduation distributions in science and engineering, and a discussion of the need for, and factors related to, increasing enrollment in America's postsecondary science and engineering programs.

Section III of the report provides a discussion of college and university roles in economic development. While the primary role of higher education is the development of human resources, emerging roles include economic research and analysis, capacity building, providing technical assistance, technology transfer, and new business development. Types of higher education institutions and their possible roles in economic development are discussed as well as the current involvement of Missouri's colleges and universities in selected programs. Also presented are the Coordinating Board's past, current and future studies and reports that provide valuable information for the development of plans for strengthening the role of Missouri higher education in economic development and planning for the future economic vitality of the state.

A comparative analysis of some factors of higher education related to economic development for Missouri and ten of its competitor states is presented in the Section IV of the report. These factors relate to higher education research capacity and research funding from federal and state government sources.

The preparation of this report required the gathering of information from many sources and could not have been completed without the special help provided by Mr. John S. Johnson, Manager of Business Development, Missouri Department of Economic Development.

The National Science Foundation provided much of the data used for the comparative analyses of Missouri higher education and that of its competitor states.

Introduction

A major public policy issue today is how states can improve the quality and performance of their higher education institutions and systems in general and how they can better respond to the many and varied initiatives and demands placed upon them related to economic development issues. The increased economic competition among states and with other nations has focused greater attention than ever before on factors related to the quality of the educational infrastructure as it impacts on economic development. Such attention has fostered increased awareness by business, elected officials and state higher education leaders on the variety of roles higher education has in contributing to the economic vitality of the nation and states. Owing to the potential for significant contributions of higher education to the state's economic agenda, the Missouri Coordinating Board for Higher Education directed that this report be prepared as one product of its Action Items for 1989-90 related to the Board's constitutional and statutory responsibility for strategic statewide planning.

Any discussion of the role of higher education in economic development must be viewed in the context of the major transformations now occurring in American society which include the shift from an industrial-based to a service- and high technology-based society and the emergence of a highly competitive, "global" economy. The changes now occurring warrant a thoughtful appraisal of the state's and nation's ability to respond to the major forces shaping our future economy: the "internationalization" of the economy and subsequent global competition, the rapid changes in technology and attendant demands for a skilled workforce adaptable to changes in the workplace and capable of lifelong learning, and changing demographics.

Government reports and the popular media are replete with instances of America's waning performance in the educational arena. The ability of the United States to compete successfully in a global economy while maintaining a competitive edge resides, ultimately, on the ability of our educational infrastructure to provide our nation and states with the highest quality education available to ensure that our human resources are second to none. It is in the arena of human resource development, and the quality of that development, that American higher education is ultimately best prepared to stimulate and abet insightful action in response to the issues of, and demands for, economic development. In this regard, the singular most critical factor affecting human resource development is the classroom teacher.

Recognition of improvement in the quality of teachers as crucial to securing the nation's economic future was aptly noted by Lyman A. Glenny, professor emeritas of the University of California-Berkeley, in a 1985 essay on state coordination prepared for the State Higher Education Executive Officers Association. In addressing issues for the 1980s and beyond, Glenny wrote:

> Our ability to attract very able students into the teaching profession at all levels of education, K through PhD, has potentially the most serious and long-lasting consequences for societal welfare. National commissions can make recommendations on this problem, but the coordinating agencies and the colleges and universities must take positive, practical steps to improve teacher educa-

> tion programs and to find ways to attract students into them. Similar steps are needed for preparation of college-level teachers. Initiatives must start now, to prevent grave impairment of the teacher corps (page 16).

Derek Bok, president of Harvard University would agree and would add that improvement in the quality of teachers and teacher preparation programs are more essential to long-range economic development than any other role higher education may have in contributing to an economic development agenda. In his 1989 keynote address to the American Council on Education, Bok argued that the critical role of higher education in economic development is not in the area of research, but rather in improving education by improving the preparation of teachers, principals and superintendents and by using technology to improve instruction and learning in subjects such as math and the sciences. Bok also suggests a targeting of resources for academic program improvements to ensure that programs are responsive to existing and emerging societal needs.

Historically, American higher education has always had an essential role in stimulating and abetting insightful action in periods of change. This report, therefore, describes issues, roles and analyses related to Missouri's system of higher education within the changing context of Missouri's potential for economic development.

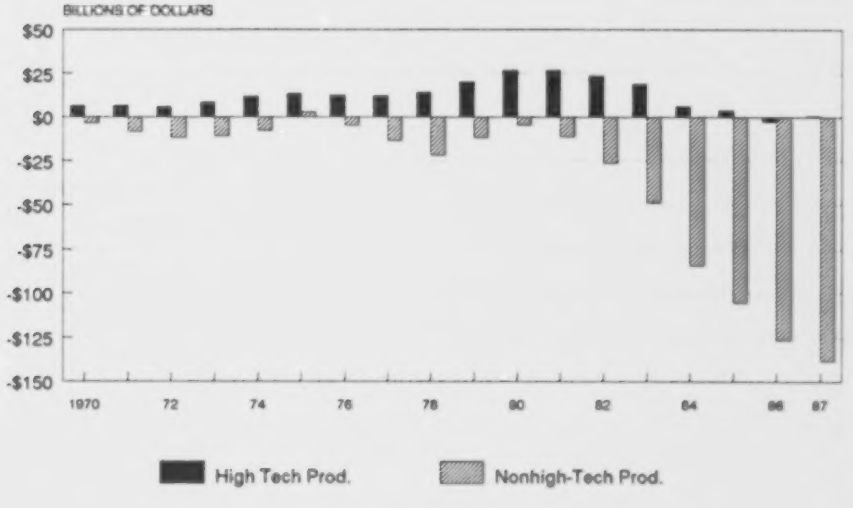
The Changing Context of Economic Competition

An International Economy

The "U.S. economy" is somewhat of a misnomer -- rather, there exists an international marketplace for the exchange of goods, services, investment capital and information. Beginning in the early 1970s, Japan and other newly industrialized countries initiated aggressive, government supported strategies to capture world markets for their exports. Low labor rates in Korea, Taiwan, Brazil and other nations have served to capture a greater share of world business production contributing to a rapidly increasing volume of world trade. Currently, more than 70 percent of American products must compete with foreign-made goods -- and we are losing to the competition! This loss is reflected in trends in the U.S. trade balance shown in Figure 1.

Figure 1

U.S.TRADE BALANCE IN HIGH-TECH AND NONHIGH-TECH MANUFACTURED PRODUCTS, 1970-1987



Source: National Science Foundation, "Science and Technology Data Book," 1989

The trends show a U.S. trade deficit in nonhigh-technology manufactured products since 1970 (except for a slight surplus in 1975). Since 1982, this deficit has increased at a precipitous rate reaching $138.3 billion by 1987. In the area of high-technology manufactured products, long believed to be the relatively exclusive province of the U.S., the country enjoyed a stable or increasing trade surplus reaching $26.7 billion in 1980.

Starting in 1980 however, this trade surplus began to decrease rapidly--reaching a deficit of $2.6 billion in 1986. Although a slight surplus ($ .6 billion) is shown for 1987, it remains to be seen whether this trade surplus will continue to grow to the levels of the early 1980s.

Figures for 1988 show an overall U.S. trade deficit of $137.9 billion while Japan and West Germany show respective trade surpluses of $77.4 and $87.7 billion. For 1989, the U.S. is projected to show a trade deficit of $139 billion while Japan, West Germany, Switzerland, Holland, Belgium, Taiwan, and South Korea collectively will show a surplus of $177 billion (Newsweek, July 17, 1989).

U.S. competitiveness in world markets is slipping.

Another indication of the United States' reduced position in international competition is revealed by the fact that during much of the 1970s, the U.S. lagged Japan, France, Canada, Great Britain, and West Germany in expenditures for plants and equipment as a percentage of total output and by 1980 had ranked lowest among its major competitors in exports as a percentage of Gross National Product (Helms, 1981). By the late 1970s, productivity in some manufacturing industries in Japan and West Germany equalled, and in some instances surpassed (e.g., automobiles), that of the U.S. The comparatively slower productivity growth of U.S. firms in the late 1970s began to seriously affect U.S. competitiveness. Between 1975 and 1980, output per hour in U.S. manufacturing increased by an average of 1.7 percent per year while that of West Germany rose 3.8 percent and in Japan, 8.6 percent (Workforce 2000).

In contrast, during the early postwar era and throughout the 1960s, the United States dominated world trade even though only a small portion of its Gross National Product (GNP) was devoted to exports. In 1960, for example, the U.S. controlled about 20 percent of world trade with less than 6 percent of its GNP devoted to exports. By 1984, however, the U.S. share of world exports had dropped to below 9 percent while more than 10 percent of its GNP was devoted to exports and about 13 percent to imports (Workforce 2000, 1987).

Also, the international share of all direct investment holdings owned by U.S. residents fell from 48 percent in 1973 to 34 percent in 1984 with most of this reduction occurring between 1981 and 1984. About one-half of the reduced U.S. share was taken up by two countries -- Japan and West Germany -- that are generally considered to be our strongest technological competitors. This substantial growth in direct investment holdings by other countries reflects the heightened competition in international markets in which U.S. firms operate.

Foreign Investment in the United States: Capital and Human Resources

Coinciding with the decreasing U.S. trade balance and share of international direct investment has been a rapid increase of foreign investment in U.S. factories, businesses, government securities, stocks and bank deposits. In the ten year period 1977-1986, foreign investment in U.S. factories, banks, businesses, buildings and equipment increased almost fivefold, from $66.7 billion in 1977 to $317.6 billion in 1986. Foreign investment in U.S. government securities, corporate stocks, and bank deposits grew from $399.6 billion in 1980 to $1,158 billion in 1987. In Missouri, by 1986, the dollar value of foreign-owned plants, property and equipment was $3.487 billion, representing about

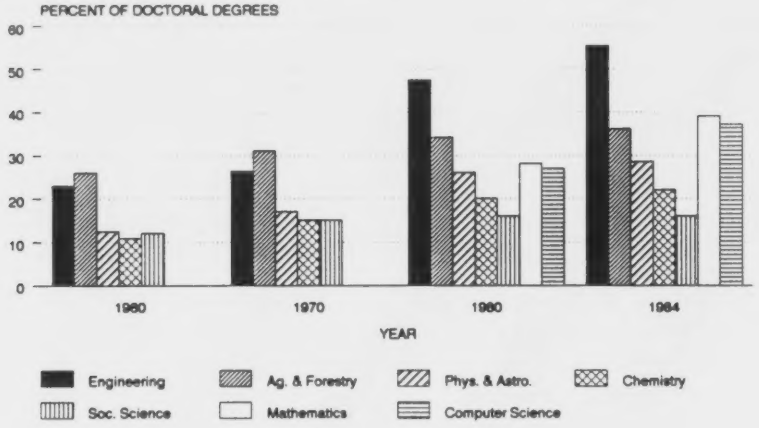
4.2 percent of the Gross State Product. Viewed from this perspective, the direction of the U.S. economy in the future will be significantly influenced by events and decisions made in an international arena. World economic growth rates and competitive actions of other industrialized nations will significantly affect policy development and action in the U.S.

Not only are foreign nations increasing their capital asset investments in the U.S., but they are also increasing their human resource investments as shown in Figure 2. Since 1960 the number of doctoral degrees awarded in the U.S. to foreign students has increased dramatically in all major areas of science and engineering. In 1960 foreign students received less than 25 percent of the doctorates in engineering but, by 1984 they accounted for over 55 percent. Similar trends, though not of comparable magnitude, can be observed for doctorates awarded in agriculture, physics, chemistry, and the social sciences. In the four-year period 1980-1984, the percentages of doctorates awarded to foreign students in mathematics increased from 28 to 39 percent and in computer science, from 27 to 37 percent. By 1987 (not shown in Figure 2) foreign nationals received over half of all doctorates awarded in the U.S. in four of the five top engineering fields: electrical - 53.5 percent; mechanical - 62 percent; chemical - 45 percent; civil - 64 percent; materials - 52 percent; and for the total number of engineering doctorates - 56 percent (National Science Foundation - Division of Science Resources Studies, 1989).

There has been a dramatic increase in the number of U.S. science and engineering doctorates awarded to foreign students.

Figure 2

DOCTORAL DEGREES AWARDED IN THE U.S.
TO FOREIGN STUDENTS



Source: Economic Road Maps, Nos. 2007-2008. The Conference Board, October 1988.

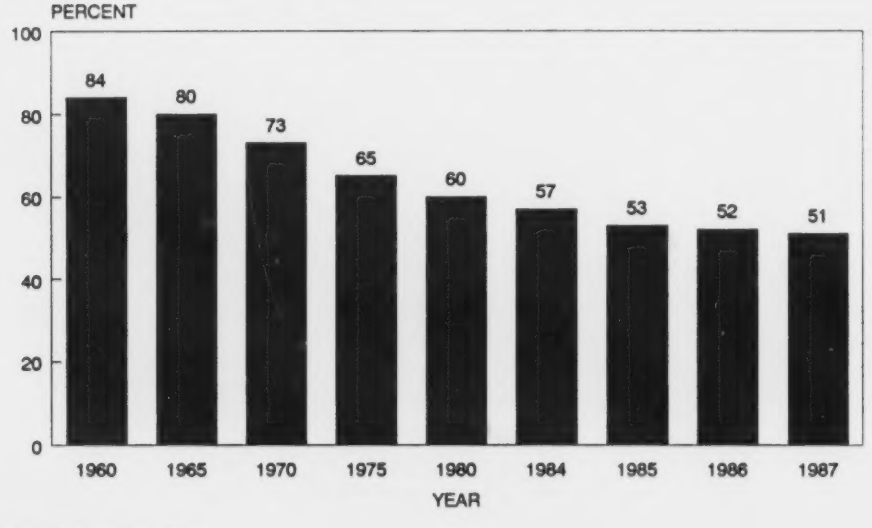
Since 1960 our pre-eminence in innovation within our own country has steadily eroded as evidenced by the patent data shown in Figure 3. In 1960 U.S. citizens accounted for 84 percent of the patents granted in this country. By 1987 this figure had been reduced to 51 percent with foreign nationals accounting for the balance of patent applications

America's pre-eminence in innovation is eroding.

filed. Other data show that, between 1975-84, the Japanese share of U.S. patents increased from 9 to 17 percent with a concentration in the relatively high technology areas of consumer electronics, semi-conductors, photography and photocopying, automotive, instrumentation technologies, and pharmaceuticals and pharmaceutical chemistry (National Science Foundation Project Summaries, 1988). To regain our former position in innovation will require sustained commitment toward developing our educational infrastructure to its fullest potential to ensure that our nation's youth and adults have available to them the finest educational resources we can provide.

Figure 3

PATENTS GRANTED TO U.S. NATIONALS
AS A PERCENT OF ALL PATENTS
GRANTED IN THE U.S.



Source: National Science Foundation,
Science and Technology Data Book, 1989.

Changes in Technology

In a review of literature pertaining to higher education and technology, Johnson (1984) identified three recurring themes: (1) America is perceived as losing ground to other industrial nations; (2) major changes are occurring in the nature of our economic growth; and (3) advanced technology is a key factor to future prosperity.

The renewed emphasis on developing a high-quality educational infrastructure is in part related to where states and industrialized nations now are in the evolution of their

economic development. Economic development in industrialized nations typically follows a pattern in which agricultural production shifts to manufacturing and then to a serviced-based economy. Since the turn of the century the U.S. has been well-served by an industrial economy which, itself, had replaced an earlier agrarian economy. This industrial economy is now being replaced by a new, knowledge – and service-based economy in which major employment growth occurs in sectors such as advanced manufacturing, information, services, and high technology. In 1985 service industries in the U.S. employed 72.6 million workers, or approximately 68 percent of the workforce. By the year 2000, the service industry share is projected to reach 96.5 million workers, or 73.7 percent of the workforce (Workforce 2000). An indication of the change ahead is that the wholesale and retail trade and service sectors are predicted to add more jobs between now and the year 2000 than presently exist in all U.S. manufacturing. Also, much of this growth (51.5 percent between 1982-86) is occurring in new, small, and medium-sized businesses employing fewer than 100 workers (Wall Street Journal, November 8, 1988).

Employment and relative output in manufacturing and goods production will continue to decline. By the year 2000, manufacturing industries will employ only 14 percent of the U.S. workforce (2.2 million fewer workers than today). While manufacturing output will increase -- due mainly to increases in efficiency and manufacturing technology -- its percent of our GNP will shrink to 17 percent from its current 21 percent. Conversely, services will increase from a current 69 percent of the economy to about 75 percent (Workforce 2000).

A more detailed view of the changing occupational structure in the U.S. for the period 1984-2000 is presented in Table 1. These projections show that almost 26 million new jobs will become available between 1984 and the turn of the century. Employment growth in the professional and technical, managerial, sales, and service areas will far surpass opportunities in other fields and will account for over 85 percent of the new jobs. Although the average rate of growth across all occupational categories shown is about 25 percent, the allied health professions, legal and scientific fields will grow two to three times as fast. In contrast, many blue collar and agriculture-related jobs will show net declines. Furthermore, of the 26 million new jobs that will be created, more than half will require additional education beyond high school, and over 30 percent will be filled by college graduates. Currently, only 22 percent of occupations require a college degree.

Almost 35 percent (about 9 million) of the projected 26 million new jobs will <u>not</u>, however, require any education beyond high school. These jobs are predominately in the labor intensive retail and service occupational categories, paying low wages, offering little opportunity for advancement, and often affected by downturns in the economy. For many individuals with these jobs, the high school experience may be their last planned, formal educational opportunity. To leverage better jobs with higher pay in their future, these individuals will find that they must be sufficiently prepared and have the ability to obtain additional postsecondary education or training. Inadequate preparation at the high school level will seriously limit their ability to do so. Enhancing the quality of teaching provided at the elementary and secondary levels is just as important to the future well-being of these individuals as to those planning to attend a college or university immediately upon graduation from high school.

Table 1

Changing Occupational Structure, 1984-2000

Occupation	Current Jobs (thousands)	New Jobs (thousands)	Growth (percent)
Total	105,008	25,952	25%
Service Occupations	16,059	5,957	37%
Managerial & Management Related	10,893	4,280	39%
Marketing & Sales	10,656	4,150	39%
Administrative Support	18,483	3,620	20%
Technicians	3,146	1,389	44%
Health Diagnosing & Treating Occupations	2,478	1,384	53%
Teachers, Librarians & Counselors	4,437	1,381	31%
Mechanics, Installers & Repairers	4,264	966	23%
Transportation & Heavy Equip. Operators	4,604	752	16%
Engineers, Architects & Surveyors	1,447	600	41%
Construction Trades	3,127	595	19%
Natural, Computer & Math Sciences	647	442	68%
Writers, Artists, Entertainers & Athletes	1,092	425	39%
Other Professionals & Paraprofessionals	825	355	43%
Lawyers & Judges	457	326	71%
Social, Recreational & Religious Workers	759	235	31%
Helpers & Laborers	4,168	205	5%
Social Scientists	173	70	40%
Precision Production Workers	2,790	61	2%
Plant & System Workers	275	36	13%
Blue Collar Supervisors	1,442	-6	0%
Miners	175	-28	-16%
Hand Workers, Assemblers & Fabricators	2,604	-179	-7%
Machine Setters, Operators & Tender	5,527	-448	-8%
Agriculture, Forestry & Fisheries	4,480	-538	-12%

Source: "Workforce 2000: Work and Workers for the 21st Century," Hudson Institute, 1987.

Labor demand and economic projections for Missouri show that, by the year 2000, the service and retail sectors will account for 47 percent of the state's wage and salaried workers while the manufacturing sector will fall from a current 22.2 percent of the workforce to 17.1 percent (Missouri Opportunity 2000 Commission). The largest employment increases will occur in the service sectors (from 20 percent currently to 28.9 percent by the year 2000).

Emerging technologies in manufacturing (e.g., robotics and materials engineering), agriculture (e.g., biogenics), information systems (e.g., artificial intelligence and superconductivity), and the health services and other professions create rapid increases in the knowledge and skills required for successful job performance in an increasingly competitive environment. Even those with college degrees will require, throughout their working lives, additional training or retraining to enable them to adapt to a rapidly changing work environment. It is estimated that the skills of almost half of the work force may be obsolete by the year 2000 (Lynton, 1981) and in certain highly specialized fields obsolesence will occur at a more rapid rate, e.g., about 50 percent of an engineer's professional knowledge may be obsolete in from 3 to 5 years (Lyall, 1986). It has also been generally reported that current entrants into the workforce will typically change occupations three times and change jobs six to seven times during their working lives either by choice or through changes resulting from market shifts or innovations in technology. Occupational and job changes invariably require the acquisition of new knowlege and the development of additional skills for successful performance. These skills include "the ability to communicate complex ideas, to analyze and solve complex problems, to identify order and find direction in an ambiguous and uncertain environment, and to think and reason abstractly" (Cohen, 1989, page 1). Recruiting and training quality teachers to develop these skills in our children, adolescents and adults should be our highest priority since the very foundation of our future resides in the quality of education provided to our workforce. Yet, in Missouri, 365,000 adults, 11 percent of the adult population, are functionally illiterate and 25 percent of high school students will drop out before graduation (Governor's Advisory Council on Literacy, 1988).

The problem is further exacerbated by the fact that, as a result of the "baby boom," almost 85 percent of those who will be in the work force in the year 2000 are already adults, and most are already working (Choate, 1986). It is these adults who will bear the brunt of the skill acquisition demands of the changing economy.

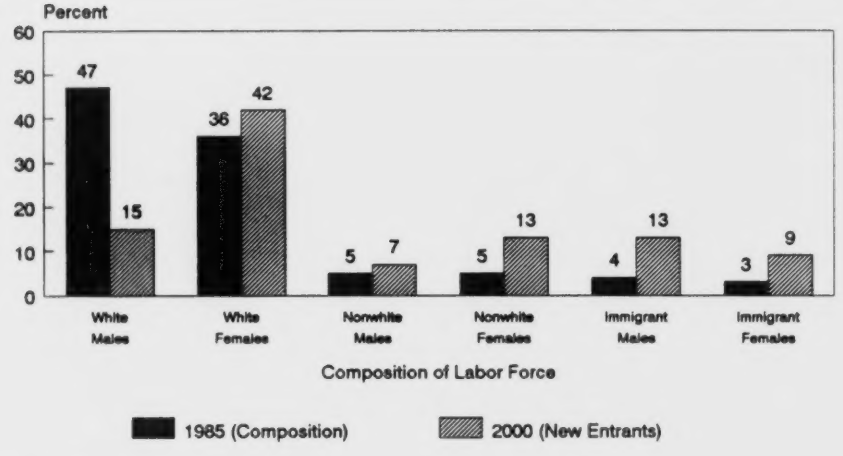
Most new entrants to the labor force will be females, nonwhites, or immigrants.

Changing Demographics

Between now and the turn of the century the composition of the U.S. labor force will change dramatically as shown in Figure 4. Over the next 10 years, most new entrants to the labor force will be females, nonwhite or immigrants. White males, who are now 47 percent of the work force, will provide only 15 percent of the net additions to the labor force. Immigrants (males and females), currently about 7 percent of the work force, will account for 22 percent of new entrants. Minorities (especially blacks and Hispanics), who are now 10 percent of the work force, will account for 20 percent of new entrants and comprise 29 percent of the work force by the year 2000. The largest share of new entrants (42 percent) will be white females who are currently 36 percent of the labor force.

Figure 4

COMPARISON OF THE COMPOSITION OF THE CURRENT LABOR FORCE TO NEW ENTRANTS: 1985-2000



Source: Workforce 2000: Work and Workers for the 21st Century, Hudson Institute, 1987.

By the year 2000, the traditional 18 to 24 year-old college-age group will represent less than 10 percent of the U.S. population.

During the 1970s, Missouri's labor force increased by about 400,000 persons (20 percent) due mainly to the entry of baby boomers and women. In 1970, 43 percent of all females over the age of 15 participated in the work force -- by 1985, 53 percent were participating. However, future labor force growth is expected to be well below the 20 percent recorded between 1970-1980. Growth rates are expected to fall to 13 percent during the 1980s and to 9 percent during the 1990s. Much of the future growth will come from increasing participation by female workers whose numbers are expected to grow by 23 percent (to 1.3 million) between 1985 and 2000 while the number of male workers in Missouri is expected to grow by only 10 percent (to 1.5 million). By the year 2000, Missouri's civilian labor force is projected to reach 2.9 million workers with women comprising just under half of the workforce (Missouri Opportunity 2000 Commission).

Equally important is the demographic trend which shows the dramatic shift in the age composition of the population. From 1950 to 1982, the number of 18-24 year-olds (the traditional college-age population) in the U.S. increased from 16 million to almost 30.4 million. The years 1982-1995 will witness a steady decrease in the size of this population (down to approximately 23.7 million). Beginning in the mid-1990s, the college-age population will again increase, so that by the year 2000 the number will nearly equal the 1970 figure of 24.7 million but will remain far below the 1982 high of 30.4 million. Proportionally, the population of 18-24 year-olds peaked in 1980, representing 13.4 percent of the U.S. population. By 1995 the 18-24 year-old group will represent only 9.3 percent of the population and by the year 2000 will increase to only 9.6 percent of the population. While the traditional college-age population will decline, adults over age 25

will represent increasing proportions of those enrolled in postsecondary education and enrolled in graduate and professional schools. For example, in 1988 over 20 percent of the total headcount enrollment of undergraduate degree-seeking students attending Missouri's public four-year colleges and universities were over age 25, and for graduate and first-professional degree-seeking students. This figure was 78 percent.

Concomitant with the decrease in the size of the traditional college-age population will be a significant increase in minority representation. In 1980 minorities comprised 15.5 percent of the population of 18-24 year-olds. Throughout the rest of this century and well into the next, minority representation will show a continual increase reaching 30.6 percent by the year 2000, 39.2 percent by 2025, and 44.4 percent by the year 2050.

Demographic trends for the general population of Missouri's 18 to 24 year-olds pattern the nation, reaching 12.9 percent in 1980, steadily decreasing to 9.2 percent in 1995, and showing a slight increase to 9.3 percent by the year 2000. Data on projected changes in the minority composition of Missouri's college-age population are not currently available but might be expected to follow those of the nation when projected increases in the size of Missouri's black population -- from 10.5 percent in 1980 to 11.2 percent in 2000, to 14.2 percent in 2005 -- are considered (U.S. Bureau of the Census projection and Woods and Poole Economics, 1986).

Employers will find younger workers in shorter supply.

Also, 1980 Census data reveal that Missouri ranked fifth among the states in population over the age of 60 with 13.2 percent of the population over the age of 65. The Missouri Opportunity 2000 Commision (1987) reports that, by the year 2000, this segment of Missouri's population is projected to reach three-quarters of a million persons and comprise 14 percent of the population. The late-adult population (ages 45-64) is expected to grow 25 percent in the 1990s (due to the influx of baby boomers), reaching about 1.2 million persons by the year 2000. The early-adult population (ages 25-44), consisting largely of baby boomers, grew substantially during the 1980s and by 1990 will comprise the largest segment (1.6 million) of Missouri's population. This age group will shrink somewhat during the 1990s, as older segments move into the upper age brackets. The high school and college population (ages 15-24) is expected to remain relatively stable (.7 million) throughout the 1990s. Likewise, the preschool and elementary school populations (ages under 15) are expected to remain about the same size (1.1 million) for the remainder of the century.

For Missouri and the nation, the consequences of the changing demographics are that future employers will find younger, less experienced (and lower-salaried) workers in shorter supply accompanied by rapid increases in female and minority representation in the labor pool. By the year 2000, only 17 percent of Missouri's labor force will be in the entry-level age group (under 25) with 72 percent in the "prime" working-age group (25-54). Currently, the entry-level and prime working-age groups comprise 21 and 65 percent, respectively, of Missouri's labor force. As older persons in the prime working-age group begin to reach retirement, employers will increasingly be forced to recruit from less skilled and historically underutilized population groups. It is these population groups, comprising larger portions of the U.S. and Missouri work force, that compete successfully with the work force of other nations: to ensure that Missouri and our nation are to be economically competitive.

The factors of an international economy, changes in technology, and changing demographics combine to produce unique challenges for the nation and states competing for new jobs and economic growth. These factors have direct implications for colleges and universities and are summarized in Table 2. Clearly, Missouri, like other states, will increasingly rely on the quality of its teachers and educational infrastructure in meeting the challenge of developing the human and technological resources businesses and industries will need to remain competitive in a changing world economy increasingly influenced by technological innovation.

Table 2

Implications for Colleges and Universities of the Changing U.S. Economy

Traditional Economy	New Economy	Implications for Colleges and Universities
Slow-moving technology	Rapid technical change	Increased research; Technology transfer
Distinct technical fields	Merging technical fields	Interdisciplinary programs or centers
Little foreign competition	Strong foreign competition	Knowledge of new competition
Focus on domestic markets	Focus on global markets	Knowledge of new cultures, languages
Mass-produced products for mass markets	Complex products for sophistacted consumers	Technical aid for business
Growth in volume of products sold	Growth in value added to products sold	New products and more flexible processes
Human resources as a factor of production	Human resources as a competitive edge	Stronger educational system
Slow-changing skill requirements	Rapidly changing skill requirements	Lifelong learning; Extension programs
Employment growth in Fortune 500	Employment growth in new/small firms	Support for entrepreneurship
Economic growth through smokestack chasing	Growth through new business development	Commercialization of new technologies

Source: "The New Economic Imperative and the New Opportunities for Higher Education." In "The Higher Education-Economic Development Connection: Emerging Roles for Public Colleges and Universities in a Changing Economy," American Association of State Colleges and Universities, 1986.

However, no university or state higher education system can, even with unlimited resources, serve as a panacea for economic development. The multiplicity of factors affecting a state's economic vitality extend far beyond the reach of the educational

system. Colleges and universities have differing missions with prescribed limitations and, often, a delimited regional focus. This is not to suggest, however, that higher education should not assume an active and coordinated role in contributing to the development and implementation of the state's economic development policy. Rather, colleges and universities are a major repository of talent for responding to the public's need for instruction, research, community services, and the development of ideas. Thus, in addition to higher education's crucial role in developing good teachers to secure the development of our nation's human resources, higher education supports economic development through technology and knowledge base development. An emerging and critical role of higher education in economic development is to become an active partner with the state in its economic development planning and related initiatives of its businesses and industries by utilizing all its available "thoughtware" resources to stimulate and abet insightful decision-making.

An emerging role of higher education in economic development is to become an active partner with the state.

The future ability of the United States to compete successfully in a global economy while maintaining a competitive edge in the development and application of technology resides, ultimately, in the ability of our educational system to provide our nation with the highest quality of education available to ensure that our human resources are second to none. The changing demographics in the U.S., coupled with the need for future workers to be able to adapt to changes in the workplace and to be capable of life-long learning poses unique challenges for our educational system and especially our nation's teachers. To meet these challenges successfully will require that we, as a nation, ensure that our teacher corps is among the finest in the world--comprised of the brighest and best our nation can provide.

The Importance of Good Teaching

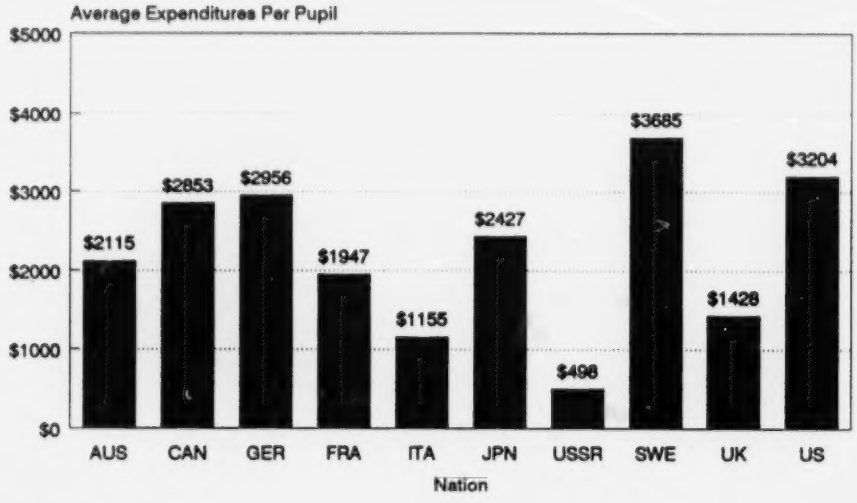
America's Educational Performance: An International Perspective

Although numerous indices can be developed to provide comparisons among our nation's youth and those of other countries, this section will focus on indices related to science and engineering since these areas are crucial to our nation's competitiveness in the development of technology.

America's waning performance in the educational arena has been well documented in recent government reports and the popular media. America's elementary and secondary students do not perform as well as similar students from other nations. This has not occurred simply for lack of funding. Comparative data show that, among ten industrialized nations, the average per pupil expenditure for public elementary and secondary education in the U.S. in 1985 was second only to Sweden (Figure 5).

Figure 5

AVERAGE EXPENDITURE PER PUPIL FOR PUBLIC ELEMENTARY AND SECONDARY EDUCATION, IN U.S. DOLLARS, 1985



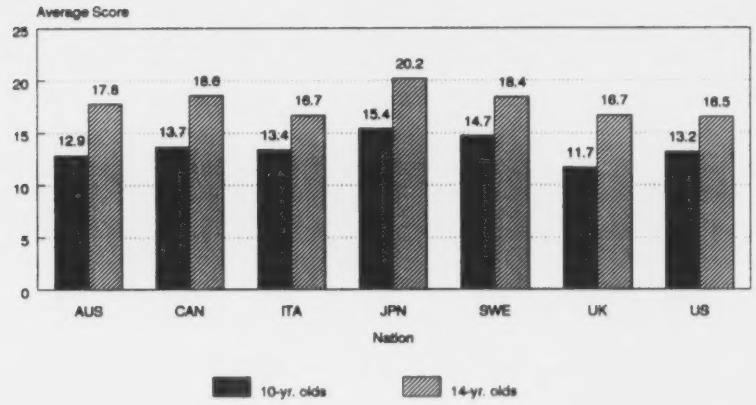
Source: "Comparative Education: Statistics on Education in the United States and Selected Foreign Nations."

Even though U.S. per pupil expenditures are comparatively high, there appears to be no direct relationship between funding level support and student achievement, at least in the areas of science education. Figure 6 shows the average science achievement test

scores for 10- and 14-year-olds in the U.S. and selected foreign nations. The science achievement performance of U.S. 10-year-olds is exceeded by comparable students in four of the six selected countries. Achievement levels of U.S. 14-year-olds are exceeded by comparable students in all of the selected countries.

Figure 6

AVERAGE SCIENCE ACHIEVEMENT TEST SCORES
FOR 10- AND 14-YEAR-OLDS IN THE U.S. AND
SELECTED FOREIGN NATIONS, 1983-1986



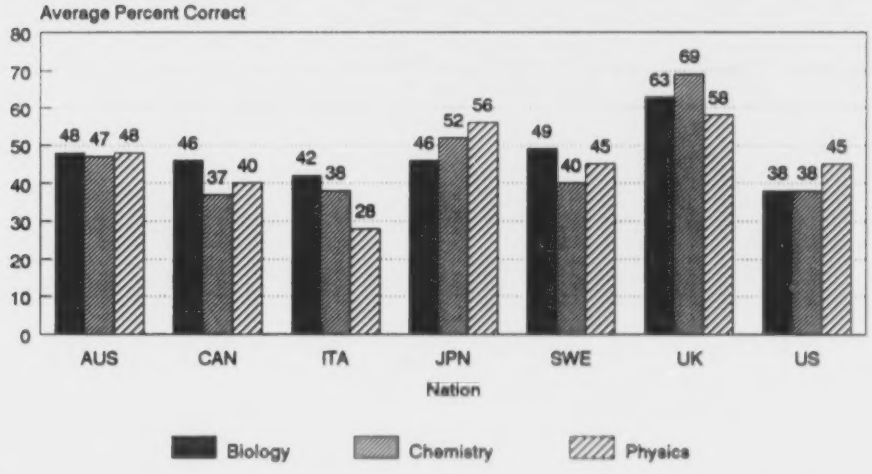
Source: "Comparative Education: Statistics on Education in the United States and Selected Foreign Nations."

Student Achievement in Science Education: A Global View

Differences in achievement test scores in specific content areas of science among U.S. 17-year-olds and comparable foreign students from six countries are shown in Figure 7. Students from all six of the other countries show higher achievement levels in biology; students from four nations show higher achievement levels in chemistry; and in physics, achievement scores of U.S. students are surpassed by three of the countries shown. Data from a 1982 study (not shown in Figure 7) examining mathematics achievement of 13- and 17-year-olds reveal that U.S. performance of 13-year-olds was exceeded by students in Canada, France, Japan, and the United Kingdom. Mathematics achievement of U.S. 17-year- olds was exceeded by students in Canada, Japan, Sweden, and the United Kingdom. Obviously, achievement test scores in areas of science and mathematics do not represent the totality of educational experience. However, for a nation that prides itself on its scientific and technological achievements, such performance by our elementary and secondary students, if not corrected, does not bode well for maintaining excellence in innovation and securing our competitive edge in science and technology development.

Figure 7

AVERAGE SCIENCE ACHIEVEMENT TEST SCORES
FOR 17-YEAR-OLD STUDENTS IN THE U.S.
AND SELECTED FOREIGN NATIONS, 1983-1986



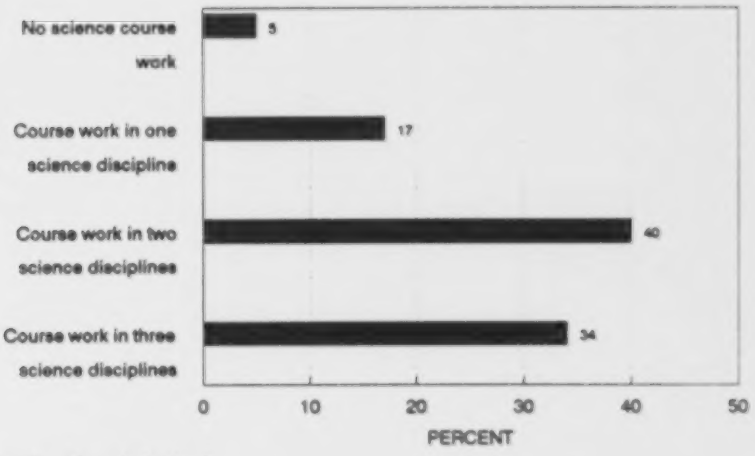
Source: "Comparative Education: Statistics on Education in the United States and Selected Foreign Nations."

An interest in science begins in the elementary grades and must be nurtured to develop fully and to maintain itself throughout the school years. The National Science Teachers' Association recommends that elementary school (K-6) science teachers have course work in three science disciplines. Yet, a 1985-86 survey by the American Association for the Advancement of Science revealed that less than 35 percent of elementary grade science teachers had met this standard (Figure 8). The survey also showed that only 40 percent of teachers received course work in two science disciplines, and about 17 percent had received course work in only one discipline. Furthermore, the survey revealed that almost five percent of science teachers had received no science course work.

The ultimate fruition of the inability to stimulate and maintain an interest in science at the elementary and secondary school level can be seen in the science and engineering "pipeline" data shown in Figure 9. Of the 4 million U.S. 1977 high school sophomores, 18 percent (730,000) were interested in science and engineering. Only about half of these students (9 percent or 340,000) enrolled as freshmen science and engineering students in 1980; yet by 1984, only about 206,000 had received a Bachelor of Science degree. Of these 206,000 BS recipients, only about 9,700 are expected to have completed a PhD by 1992.

Figure 8

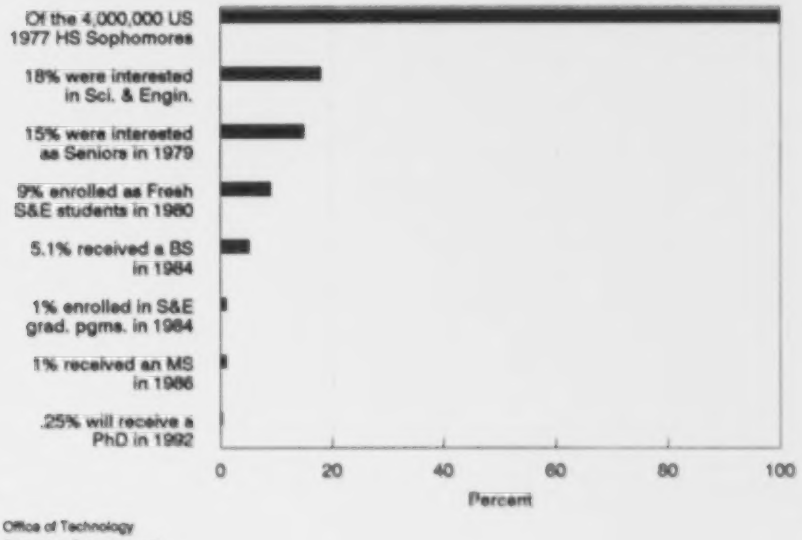
K-6 TEACHERS MEETING NATIONAL SCIENCE TEACHERS' ASSOCIATION STANDARDS 1985-1986



Source: American Association for the Advancement of Science

Figure 9

NATURAL SCIENCE/ENGINEERING PIPELINE: From High School Through Graduate School


Of the 4,000,000 US 1977 HS Sophomores
18% were interested in Sci. & Engin.
15% were interested as Seniors in 1979
9% enrolled as Fresh S&E students in 1980
5.1% received a BS in 1984
1% enrolled in S&E grad. pgms. in 1984
1% received an MS in 1986
.25% will receive a PhD in 1992
0
20
40
60
80
100
Percent

Source: U.S. Office of Technology Assessment, Educating Scientists and Engineers: Grade School to Grad School

In Missouri, since the inception of the Education for Economic Security Act (EESA) in 1985, the Coordinating Board for Higher Education has authorized the expenditure of over $1.9 million to fund 99 training projects designed to improve instruction in science, mathematics, computer learning, and foreign languages at the elementary and secondary level. Providing for the continuing education of teachers in these subject-matter areas is an important element of strengthening the state's educational infrastructure and will hopefully increase the flow of Missouri students through the science and engineering pipeline.

Differences in Students' Interest in Science and Engineering Fields of Study: An International Perspective

Differences in students' interest in science and engineering fields of study among the U.S. and 11 other nations can be seen in the enrollment data shown in Table 3. Almost 11 million students were enrolled in postsecondary education in the U.S. in 1985. The aggregate enrollment in the U.S. for the natural and health sciences, mathematics, and engineering was 30.1 percent, and it is reasonable to assume that many of these students were nonresident aliens. Although, in actual numbers, U.S. aggregate science and engineering enrollment exceeds that of all other nations, many of the other nations show proportionally more student interest in science and engineering fields as reflected in their respective aggregate science, math, and engineering enrollments.

While enrollments may reflect differences in student interests and intents, the numbers and percentages of graduates reflect the more important factor of completions and postsecondary degree entrants to the labor force pool. The total number of graduates and percent distributions in the science and engineering fields for the U.S. and these foreign nations are shown in Table 4. These data show that completions for the aggregate of the fields of natural and health sciences, math, and engineering accounted for only 18.9 percent of degrees awarded in the United States. For the other countries, the aggregate of degrees awarded in these fields range from 24.0 percent (Japan) to 51.3 percent (Italy).

As the "pipeline" and degree completions data show, smaller proportions of U.S. postsecondary students are choosing careers in the sciences and engineering fields. While some more recent national enrollment and completions data suggest that these enrollments and completions may be increasing, it remains to be seen whether or not such increases will maintain momentum. More troublesome is the fact that few women and minorities are employed as scientists and engineers in the U.S. As Figure 10 (page 22) shows, in 1986 women comprised only 15 percent of employed scientists and engineers. Blacks and Hispanics were more significantly underrepresented--comprising, respectively, 2.5 and 2 percent of employed scientists and engineers. With the changing demographics and changes in the future composition of the U.S. labor force (refer to Figure 4, page 10), methods must be found for significantly increasing women and minority representation in the science and engineering fields to avoid further erosion of our nation's stature in technology and innovation.

Women and minorities are significantly underrepresented in science and engineering fields.

Table 3

Total Enrollment in Postsecondary Education and Percent Distribution by Fields of Study: United States and Selected Countries, 1985

	Total Enrollment All Educ. Fields	Natural Sciences & Math	Health Sciences	Engineering	Subtotal for Natural & Health Sciences, Math & Engineering
Australia	308,856	na	6.9%	9.3%	16.2%
Canada	974,511	8.6%	8.1%	9.1%	25.8%
China	1,778,608	7.9%	9.3%	26.2%	43.4%
Federal Republic of Germany	1,550,211	11.5%	14.2%	16.7%	42.4%
France	931,943	15.9%	20.1%	1.0%	37.0%
Italy	534,595	11.2%	16.7%	1.0%	28.9%
Japan	2,403,371	2.7%	6.1%	16.9%	25.7%
Mexico	1,199,120	5.1%	12.4%	17.5%	35.0%
Soviet Union	5,147,200	na	7.3%	44.4%	51.7%
Sweden	233,442	7.9%	11.8%	27.0%	46.7%
United Kingdom	1,000,169	12.7%	15.8%	15.9%	44.4%
United States*	10,975,902	7.0%	11.9%	11.2%	30.1%

Source: "Comparative Education: Statistics on Education in the United States and Selected Foreign Nations," Congressional Research Service, Washington, DC, 1988.

* "Digest of Education Statistics, 1987," Center for Education Statistics. Data are for 1984.

Labor Market Demand for Science and Engineering Graduates

Labor market projections of science and engineering jobs in private industry are shown in Figure 11. These data show that the total of service producing jobs from 1977-86 and projected from 1986-2000 shows significantly higher average annual growth than past and projected job growth in the goods producing sector. Furthermore, within the goods and service producing sectors future growth in science and engineering jobs, while less than past growth, will show average annual increases of about 1.8 percent and 3.5 percent respectively. These growth rates far exceed the growth rate for the total of the goods producing sector.

Table 4

Total Graduates of Postsecondary Institutions and Percent Distribution in Science and Engineering: United States and Selected Countries, 1985

	Total Graduates All Educ. Fields	Natural Sciences & Math	Health Sciences	Engineering	Natural & Health Sciences, Math & Engineering
Australia	68,956	12.5%	6.5%	5.8%	24.8%
Canada	193,432	4.2%	10.0%	10.7%	24.9%
China	335,210	7.6%	8.9%	24.2%	40.7%
Federal Republic of Germany	226,307	5.0%	26.0%	9.4%	40.4%
France	269,841	14.7%	9.9%	5.6%	30.2%
Italy	90,645	9.5%	35.0%	6.8%	51.3%
Japan	576,487	2.5%	5.0%	16.5%	24.0%
Mexico	113,100	4.0%	16.8%	13.9%	34.7%
Soviet Union	na	na	na	na	na
Sweden	na	na	na	na	na
United Kingdom	258,599	5.7%	22.1%	16.7%	44.5%
United States	1,830,258	3.4%	10.0%	5.5%	18.9%

Source: "Comparative Education: Statistics on Education in the United States and Selected Foreign Nations," Congressional Research Service, Washington, DC, 1988.

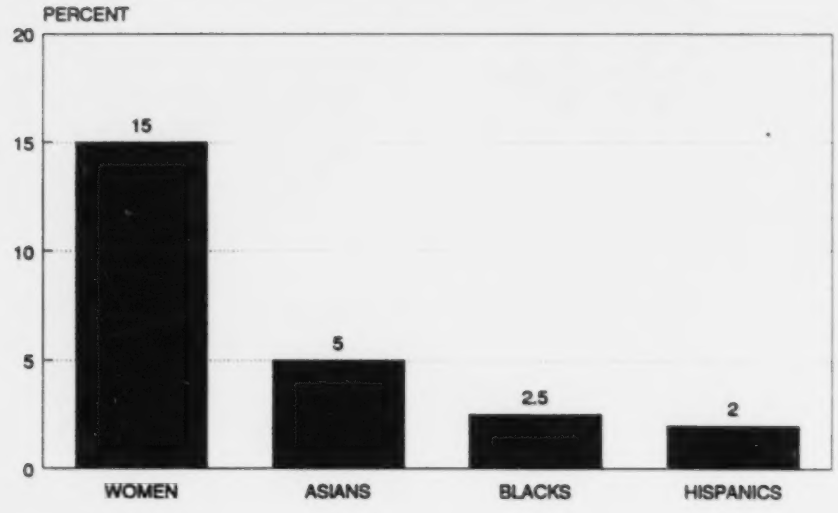
Faculty Shortages in Science and Engineering

Faculty shortages in virtually all areas of higher education can be expected by the turn of the century.

The nation's lower proportion of postsecondary science and engineering graduates and the lack of adequate representation of women and minorities in science and engineering fields both affects, and is affected by, faculty shortages in science and engineering fields. A 1988 survey by the American Council on Education (Figure 12) reports that among doctoral granting institutions, over 80 percent report faculty shortages in computer science, over 60 percent report faculty shortages in engineering, over 30 percent indicate shortages in mathematics, and over 20 percent indicate shortages in the physical sciences. Faculty shortages are not only a problem for these fields, however, as nationally, over 20 percent of all college and university faculty are over age 55. Faculty shortages may be expected in virtually all areas of higher education by the turn of the century unless efforts are undertaken to recruit more of our nation's brightest students into teaching at the higher education level.

Figure 10

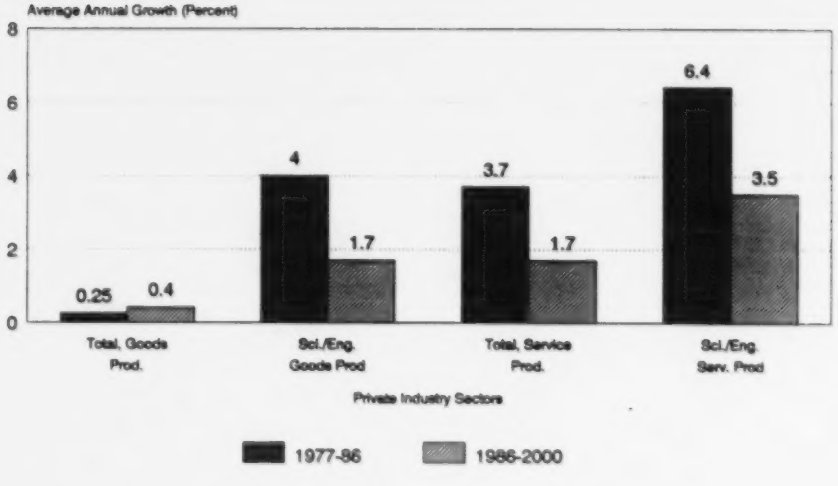
WOMEN AND MINORITIES AS A PERCENT OF EMPLOYED SCIENTISTS AND ENGINEERS IN THE U.S. IN 1986



Source: National Science Foundation

Figure 11

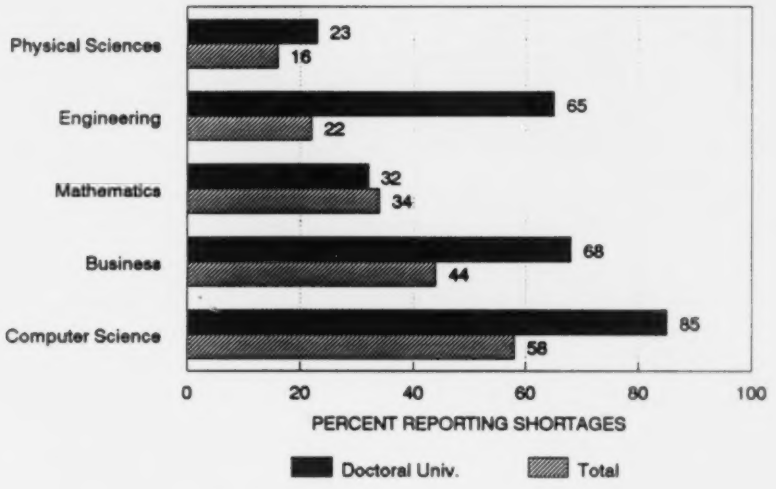
AVERAGE ANNUAL GROWTH IN TOTAL AND SCIENTIST/ENGINEER JOBS IN PRIVATE INDUSTRY BY SECTOR



Source: National Science Foundation, Science Resources Studies, Dec. 30, 1988

Figure 12

COLLEGES AND UNIVERSITIES WITH FACULTY SHORTAGES, SELECTED FIELDS, 1988



Source: American Council on Education

Faculty shortages at colleges and universities result from numerous factors; relatively low pay as compared to that offered by business and industry, increasing time required to acquire a doctorate, and the high cost of graduate study are just a few of the factors related to fewer students choosing to pursue advanced graduate study. Another factor affecting the dearth of faculty, especially in engineering could be a result of the increasing number of foreign students in our graduate science and engineering programs. Figure 13 shows the relative percentages of doctorates awarded in the U.S. in 1987 to U.S. citizens and foreign nationals in engineering fields. In every field except chemical engineering, more doctorates were awarded to foreign nationals than to U.S. citizens.

In Missouri, during the four-year period 1985-1988, nonresident aliens accounted for 61 percent of the doctorates in engineering awarded by Missouri public universities, 54 percent of doctorates in agricultural sciences, 22 percent of computer science doctorates, 23 percent of life sciences doctorates, 48 percent of mathematics doctorates, 52 percent of doctorates in the physical sciences, and 29 percent of social sciences doctorates.

While it could be argued that these trends are a natural byproduct of an increasingly international economy, we are, in effect, providing all the benefits of American higher education to our competitor nations.

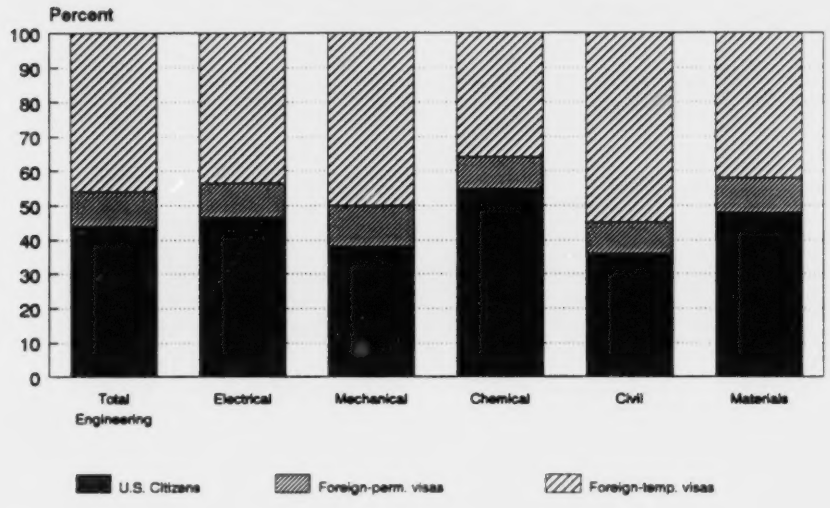
These data make clear that our youth today are not achieving as well as the youth of other nations. Our youth are America's future labor force – the labor force America will depend upon to remain competitive in a global economy. This disadvantage of under-

achieving youth, if not corrected, will have long-range negative effects on the ability of our future labor force to compete with the future labor force's of other nations.

To secure our future requires that we reaffirm our commitment to providing our nation with quality teachers to develop and nurture, within our youth, aspirations to excellence. The consequences of complacency and the tolerance of mediocrity will serve only to betray the expectations of future generations.

Figure 13

ENGINEERING DOCTORATES IN THE TOP FIVE FIELDS BY CITIZENSHIP STATUS: 1987



Source: National Science Foundation, SRS
March 1, 1989.

College and University Roles in Economic Development

Colleges and universities are essential resources to states, communities, businesses and industries actively working toward improving their respective economies. Beachler (1985) has identified seven critical elements necessary for economic development or revitalization: (1) human resource development, (2) research and development, (3) transportation, (4) finance and legal institutions, (5) energy, (6) communication, and (7) capital goods and equipment. Human resource development and research and technology development are crucial -- and higher education plays a vital role in these areas.

Roles of Higher Education in Economic Development

While the development of human resources is the primary and essential role of higher education in our society, the spectrum of emerging roles of higher education in economic development include such elements as providing technical assistance to new and small businesses, developing technology transfer programs, and the development of new business incubators and research parks. Table 5 provides a summary of the possible roles of colleges and universities in economic development along with possible economic and institutional benefits as well as some potential concerns. Seven broad categories describe the roles of higher education in economic development:

There are several roles of higher education in economic development in addition to preparing quality teachers.

- Human resource development -- tailoring education programs to be responsive to the emerging human resource requirements of the changing economy;
- Economic research and analysis -- providing information to public and private decision makers about an area's economy;
- Capacity building -- assisting community organizations in developing the capacity to participate effectively in economic development;
- Technical assistance -- applying existing knowledge to industry by helping businesses adopt effective management and engineering principles;
- Research -- conducting basic and applied research to yield new knowledge that may result in new products and services or improved forms of production;
- Technology transfer -- helping industry to apply state-of-the-art technology developed within the university;
- New business development -- having universities assume a direct role in promoting new enterprises that utilize knowledge developed within the university (Lyall, 1986).

Table 5

The Spectrum of College and University Roles in Economic Development

Economic Objective	College and University Roles	Examples	Possible Economic Benefits	Possible Institutional Benefit	Some Potential Concerns
Human Resources Development	New education programs Continuing education Profess. development Extension programs	Arizona State Center for Eng. Excellence George Mason Institute of Science & Tech.	Skilled workers Means of updating skills Lifelong learning	New students New programs Revitalized curricula Increased responsiveness	Misreading labor market Vocational orientation Inflexible programs Need for program cuts
Economic Research and Analysis	Economic data gathering Economic base analysis Industry analysis Strategy development	Cleveland State College of Urban Affairs Eastern Oregon State Regional Services Inst.	Better information Improved decisions Effective strategies	Public-service mission Community image Student opportunities	Needs not well understood Govt./academia conflicts Invlv. in local politics Work seen as too academic
Capacity Building	Training Technical assistance Building partnerships	U. of Colorado-Denver P/P Center Western Carolina WNCT Tri-State Conference	New local capacity New partnerships	Public-service activity Community support Taps faculty skills	Lack of ties to comm. gps. Needs not well understood Invlv. in local politics Work seen as too academic
Technical Assistance	Small bus. dev. centers Productivity centers Industrial extension Faculty consulting	Georgia Tech Industrial Extension Service Univ. of Alabama/GM U. of TX-San Antonio CED	Aid to new and small business Knowledge of mgmt. and new engin. tools	New business support Research opportunities Consult. opportunities Student experiences	Drain on faculty time Not seen as prestigious Faculty resistance Lack of special resources
Research	Centers of excellence Research consortia Cooperative research Industrial affiliates	Univ. of Akron EPIC U. of California MICRO Michigan State Biotech Center	Technical edge New production processes New products and services	National visibility New research revenues Understanding of needs Access to labs, equip.	Politicization of research Conflicts of interest Threats to acad. freedom Econ. payoffs are long term
Technology Transfer	Tech. transfer program Shared equip./facilities Faculty consulting Sabbaticals	Ben Franklin Partshp. Washington Research Foundation Michigan Industrial Technology Institute	Access to technology	New revenues (royalties) Feedback to classroom Student learning Taps technology base	Lack of industry linkages Faculty resistance Compet. with private firms Lack of organiz. vehicle Academic/industry conflicts
New Business Development	Incubators Research park Financing program Entrepreneurship	Utah Innovation Center Texas A&M INVENT Ohio University	New start-up firms New jobs Increased tax base	New revenues (equity) Faculty income Improved industry ties	Lack of strong research base Requires support services Restrictive regulations Detracts from teaching roles Replicating inappropriate models

Source: "The Spectrum of College and University Roles in Economic Development." In "The Higher Education Economic Development Connection: Emerging Roles for Public Colleges and Universities in a Changing Economy," American Association of State Colleges and Universities, 1986.

Some institutions may be capable of developing the full range of roles while others, with less capacity, may focus on two or three. The choice should reflect regional needs as well as interests and specified institutional missions. Although teaching, research, and public service typically define the missions of public colleges and universities in the United States (with research deemphasized at most community colleges), a recent American Association of State Colleges and Universities (AASCU) survey of 300 state institutions revealed that 37 percent acknowledged involvement in economic development as part of their mission (AASCU, 1986). Colleges and universities cannot be all things to all people and involvement in economic development appears most effective when it supports and complements an institution's primary mission. Institutional missions, however, are not immutable: they should have an inherent flexibility for change to adapt to new realities just as many teachers colleges broadened their missions to become comprehensive universities to meet increased demands for higher education.

Institutional missions should have an inherent flexibility for change.

Developing Institutional Roles

Ten key factors have been identified (Burke, 1986) that appear to be crucial to developing appropriate and successful institutional roles for involvement in economic development. The ten key factors are:

- Entrepreneurial leadership--considered the most important factor since colleges and universities tend to be conservative institutions requiring strong leadership to provide impetus for change.

- Clear mission--a service mission that clearly supports or complements involvement in economic development.

- Well-defined and understood community and industry needs--which largely determine what and how a college or university (especially one with a regional focus) can contribute to economic development.

- Institutional capacity--success in economic development requires identifying a "market niche" and matching institutional capacities with needs of the service area.

- Strategic location--proximity to industry, population and economic centers are an advantage but telecommunications technology and providing off-campus, out-of-district services can be used to extend the "reach" of distally located institutions.

- Effective relations with the public and private sectors--ties to the private sector are a major factor in supporting a higher education role in economic development. The establishment of new institutional linkages are critical for involvement in economic development and can result from establishing community and industrial advisory boards, using industry liasons, exchange programs for faculty and industry personnel, industry sabbaticals for faculty, etc.

- Availability of resources a major factor influencing the effectiveness of institutional involvement that increasingly depends on state governments and industry to provide funds for activities and programs related to economic development needs. State

funds can be used to establish various centers of excellence, incubator programs, and for the expansion of industry-related programs. Industry funding can be for human resource development through contracts for employee training and retraining, research contracts, general programs relating to local needs, and endowed chairs.

- Supportive institutional culture -- that recognizes the importance of economic development and provides faculty and staff with an understanding of the benefits of involvement with economic development and the importance of focusing some portion of the institution's training, retraining and research expertise toward the needs of business and industry.

- Supportive policies -- that provide rewards for faculty and staff involvement in economic development. Such policies should protect the integrity of the institution yet enable it to respond to community and industry needs.

- Facilitative organizational arrangements -- are important to coordinate involvement in economic development, to help promote interdisciplinary approaches on campus, and to facilitate communication with industry.

While some of these factors are beyond the direct control of an institution (e.g., strategic location), most factors can be altered with effective leadership, committment to a proactive role in economic development, and the development of appropriate organizational structures.

Institutional Organizational Models for Economic Development

There are a number of organizational models currently in use. Most common is the "centralized" model wherein coordination for economic development comes from the president's, chancellor's, or development office (e.g., University of Missouri System's Office of Economic Development). A more decentralized model where efforts are focused in specific colleges or schools might be called the "academic" model (e.g., University of Michigan).

Some institutions establish "centers for economic development" that coordinate institutional effort by involving faculty from various disciplines in providing economic development services (e.g., Center for Regional Progress at Marshall University in West Virginia; Regional Economic Assistance Center at the State University of New York, Buffalo). The Center for Technology and Small Business Development at Central Missouri State University provides an excellent example of combining a small business development program and a technology transfer program involving faculty from the institution's College of Applied Science and Technology. Since its inception in 1986, the center has secured about $250,000 in external funds and currently provides business and technical assistance to over 280 clients throughout the state.

There are several models for institutional involvement in economic development.

Recently, a number of institutions in some states have developed "centers of excellence", usually with support from state government, industry, or both (e.g., Ohio's Thomas Edison program which led to the establishment of a series of centers of excellence at various

locations). Missouri's Centers for Advanced Technology located at Washington University and the University of Missouri campuses at Columbia, Rolla, and Kansas City serve as functional equivalents.

A few universities have established "research institutes" which operate separately from their academic schools yet provide a vehicle for encouraging interdisciplinary collaboration and facilitating ties to industry (e.g., Illinois Institute of Technology; Georgia Tech Research Institute). A notable example is the Center for Scientific Research at Southwest Missouri State University which focuses on applied research grants and contracts from business and industry. Since becoming fully operational in the fall of 1987, the center has secured about $590,000 in external funds from various sources and has established important linkages with private sector businesses and industries.

Still another model uses "interuniversity" arrangements where smaller institutions establish formal linkages with the state's major universities and industries to enhance their ability to engage in economic development (e.g., the Georgia Research Consortium; Mississippi's Institute for Technology Development; the Midwest Technology Institute; the California MICRO program; the State of Illinois' faculty resource network which serves as a clearinghouse for faculty interested in working with industry).

The key factors for developing successful institutional roles and the various organizational models described above provide the basic elements for developing strategies for involvement in economic development. The individual strengths of Missouri's public colleges and universities, coupled with unique features of their respective missions, the flexibility to address emerging needs, and their locations throughout the state are important assets in planning for the state's future economic development and diversification.

Barriers to College and University Involvement in Economic Development

There are various factors that can constrain college or university involvement in economic development. Mission statements may not directly address economic development activities (although such statements that include public service could be broadly interpreted to include involvement in economic development). Developing close ties to business and industry could be perceived as a threat to an institution's independence and to faculty academic freedom. The faculty reward system may not recognize economic development as an appropriate or important activity. These and other barriers to college and university involvement in economic development along with solutions and strategies used by other institutions (as examples) are summarized in Table 6.

The lack of availability of special resources may appear to be a formidible barrier especially as federal sources (e.g., Economic Development Administration's University Center Program, and many Small Business Administration and Department of Commerce programs) tend to be targeted toward more economically disadvantaged areas and states.

Increasingly, state governments are becoming an important source of such support. For example, Missouri, through the Department of Economic Development, currently

provides $1.4 million for the Innovation Centers and $1.7 million for the Centers for Advanced Technology. Also, the Missouri General Assembly, through the University of Missouri System, provides $ .8 million for the Missouri Research Assistance Act. Inter-departmental joint ventures within colleges (e.g., between liberal arts and sciences departments) reduces competition for funds from local industries while providing for broader-based service delivery systems. At San Jose State University, for example, the English and art and music departments work with local industry in providing technical writing assistance and electronic art and music. Similarly, at the University of California-San Diego, the business school and Asian studies program collaborated in the development of a Center for International Relations and Pacific Studies to improve California's trade and relations with the Pacific Rim nations.

A major strength of Missouri's public colleges and universities is the inherent flexibility for the allocation of resources within the institutions. Such flexibility allows for the creative use of general operating appropriations in a manner productive for economic development purposes and should enable institutions to develop new roles even with limited special funding.

Table 6

Overcoming Barriers to College and University Involvement in Economic Development

Barrier	Solution	Example
Unclear mission	Strong leadership Restatement of mission Development of new mission	Eastern Oregon State University
Faculty resistance	Incentives and rewards Recruiting new faculty Recognition	Cleveland State College
Arts/sciences conflicts	Involvement of arts and humanities with industry and community	San Jose State University
Possible conflicts of interest	Development of policies to protect university interests	University of Utah
Lack of understanding of community and industry needs	Ongoing dialogue Periodic surveys, assessments	University of California, San Diego
Lack of public awareness of university resources	Communications activities	George Mason University
Lack of resources for economic development	New industry support New state programs	Ben Franklin Partnership California MICRO
Administrative constraints	More flexible policies New organizational vehicles	Georgia Institute of Technology
Poor internal communications	Interdisciplinary activities	University of Michigan
Lack of linkages to industry and community	New organizational arrangements	Jackson State University

Source: "The Requirements for Effective College and University Involvement."In "The Higher Education Economic Development Connection: Emerging Roles for Public Colleges and Universities in a Changing Economy," American Association of State Colleges and Universities, 1986.

Types of Institutions and Their Involvement in Economic Development

Colleges and universities are diverse institutions varying in mission emphasis, constituency, and location. These factors affect the breadth of roles that institutions can typically assume for involvement in economic development. The types of public higher education institutions and their possible roles for involvement in economic development are summarized in Table 7. The various roles shown for the different types of institutions are not meant to be inclusive nor prescriptive--but rather suggestive of the types of opportunities for economic development activity that could be considered beyond their primary and critical roles of human resource development.

Table 7

Types of Higher Education Institutions and Their Involvement in Economic Development

Type	Description	Usual Constituency	Possible Roles
Regional	Baccalaureate and comprehensive colleges and universities serving defined regions of the state	City or Region Rural area Small Business	Education Economic analysis Capacity building Technical assistance Applied research
Urban	Baccalaureate and comprehensive colleges and universities serving large metropolitan areas	City Urban area Small business	Education Economic analysis Capacity building Technical assistance Basic research Applied research
Historically Black	Baccalaureate and comprehensive colleges and universities serving clientele from urban and regional areas, the state and nation	City, Region, Statewide Black communities	Education Economic analysis Capacity building Technical assistance Applied research
Technological	Principally science and engineering baccalaureate and comprehensive colleges and universities serving clientele from local and regional areas, the state and nation	State Industry High tech	Education Technical assistance Applied research Technology transfer Basic research Business development
Liberal Arts	Principally baccalaureate liberal arts colleges serving clientele from local and regional areas, the state and nation	Statewide	Education Economic analysis Capacity building Applied research
Major Research Institution	Baccalaureate and doctoral degree-granting research universities serving clientele from the state and nation	State Industry High tech	Education Technical assistance Applied research Technology transfer Basic research Business development
Community Colleges	Community junior colleges located in metropolitan or urban areas serving local clientele through transfer and terminal degree programs, training and retraining of employees	City Urban area Small business	Education Capacity building Technical assistance

Source: "How Different Institutions Become Involved in Economic Development." In "The Higher Education-Economic Development Connection: Emerging Roles for Public Colleges and Universities in a Changing Economy," American Association of State Colleges and Universities, 1986. (with modifications to reflect Missouri and non-AASCU schools)

Regional universities are generally comprehensive institutions whose service area extends beyond a single city encompassing a relatively large area of a state. These institutions usually emphasize undergraduate teaching and applied research as opposed to graduate work and basic research and can develop economic development roles with a regional emphasis. An increasingly important role is that of capacity building--helping local communities build their capacity for economic development by providing local leaders of various government, community, and cooperative organizations with expertise in problem solving and strategy development to facilitate planning for economic development.

Different types of institutions can have varied roles to play in economic development

Urban universities and colleges service major metropolitan areas usually emphasizing teaching, research (both applied and basic), and providing educational opportunities for inner-city residents, minorities, immigrants, and large numbers of commuting and night school students. These institutions are ideally situated to provide a wide range of technical assistance, training, and research services to area businesses and industries and may provide capacity building services to proximate rural areas.

Historically black institutions have traditionally served the black community within a city, region, or state. Many of these institutions have developed strong economic development roles by helping blacks with capacity building in both urban and rural areas. Recently, many of these institutions have witnessed rapid increases in the enrollment of nonblack students. While historically black institutions retain a strong constituency, the increasing diversity of the student population could serve to broaden the base of support for the institution, providing increased potential for the expansion of capacity building and other economic development services to other constituencies.

Scientific and technological institutions embrace an orientation toward science and technology or toward meeting the technical needs of specific industries. While many such institutions have broadened their focus to become more comprehensive, their history and technical programs enable them to establish close linkages with industry and forging a strong role in basic and applied research and technology transfer.

Liberal arts institutions focus mainly on providing quality undergraduate programs in arts and sciences areas and often have higher admission standards than do most regional universities. It is generally believed that graduates of such institutions may find greater opportunities for the pursuit of graduate education. In this respect these institutions contribute, as do other types of schools, toward providing a nucleus of well educated individuals and serve as "feeder" institutions to graduate and doctoral-granting institutions. This can be a significant contribution to a state's overall economic development to the extent that such students can be retained in the state and the state's system of higher education. If liberal arts institutions are located in rural areas, they can also serve local/regional capacity building and applied research needs to bolster regional economic development.

Major public research institutions often were originally established as land-grant institutions. Their missions are statewide with comprehensive programs and emphasize research and graduate education. Many of these institutions continue to have strong involvement with the state's agricultural industries. Given both their breadth and depth of programs, these institutions have the capacity for a wide range of economic development activities. Many public research institutions maintain a comprehensive extension service which can include continuing education, educational outreach, and regional and statewide economic analysis. With their emphasis on both basic and applied research, these institutions can develop strong technology transfer programs to ensure that the results of research become available to the state's businesses and industries that could use the new information to achieve economic benefits and enhance their competitiveness.

Community colleges and private and public vocational-technical schools have historically provided for much of the postsecondary, nonbaccalaureate manpower instruction, training and retraining needs of community/regional business and industry. Many community colleges also offer extensive continuing education and skills development programs via the Job Training Partnership Act. Community colleges also play an important role in industry specific training and retraining. Over $10 million is available for customized training in Missouri through programs of the Department of Economic Development and the Department of Elementary and Secondary Education. Customized training is provided to new and expanding employers to encourage business growth and retention. Funds are allocated to employers for two purposes; classroom skill training and on-the-job training. Classroom skill training is usually provided by a local community college. On-the-job training funds are for wage reimbursements and is usually administered through regional administrative entities. Community colleges may also initiate capacity building programs for their service areas and, depending on their program offerings and faculty, provide technical assistance to area businesses and industries.

Community colleges can play an important role in industry specific training and retraining.

Different institutions will develop different roles in economic development depending on their mission, capacity, and circumstances. Major research institutions may have a more extensive role to play in research and development than will regional or some urban institutions. Community colleges may have a more extensive role in certain types of human resource development through programs for training and retraining employees and in special forms of technical assistance. There are several possible roles for each type of institution. Institutions with less capacity can still determine their own niche and possibly broaden their areas of collaboration with the community to provide additional opportunities for area economic development. As institutions face new demands and increased pressure to contribute to state economic development, response to these pressures will require that institutions become more strategic and entrepreneurial in their approach to developing effective roles.

Planning for Involvement in Economic Development

While the critical role of higher education in economic development involves a commitment to improving the quality of human resource development, a general framework for developing additional institutional roles in economic development has been provided by Wegener (1986). Eight key steps were identified to guide institutions in their efforts to develop appropriate roles:

- Deciding on an institutional commitment -- institutions need to consider their interest in and commitment to a role in economic development as related to their basic mission and be cognizant of the different views of their many constituencies--the state, faculty, students, alumni, donors, the community and industry. Institutions also need to determine what they want to achieve with such involvment: improved image, new resources, and/or improved programs.

- Analyzing community and industry needs -- initiating an active outreach to industry and the community to develop a clear understanding of changes in the local economy and community and industry needs in economic development including manpower, technical assistance, research and technological needs.

- Assessing institutional strengths and weaknesses -- to determine how well institutional resources/capacities in education, research and public service match identified community and industry needs and how the institution can best contribute to economic development. Identified areas of excellence are more likely to provide for greater contributions to economic development.

- Determining targets of opportunity -- to isolate specific areas where university involvment in economic development is likely to achieve maximal impact and to provide for assessments of the need for new institutional capacity to meet unmet community or industry needs.

- Defining appropriate new roles for the institution -- based on the above assessments and supportive of the institution's basic missions. Ideally such roles should build on identified strengths of the institution - with a willingness to invest resources in selected areas of comparative advantage.

- Organizing for the new roles -- to determine the extent to which new organizational arrangements might be needed or whether existing structures will suffice.

- Establishing new policies -- as necessary which foster a supportive climate for involvement with business and industry yet protect the interests of the institution.

- Implementation and follow through -- to establish leadership roles and responsibilities and to monitor and evaluate the effectiveness and impact of the economic development activities including publicizing institutional efforts and ensuring that the institution receives recognition for its contributions. Successful endeavors should serve as models for further development efforts.

Colleges and universities typically are stable, conservative institutions slow to change and in the U.S. historically have followed two basic traditions: independence from governmental control, which might imply a closer relationship with the private sector, and voluntary service to meet societal needs. Involvement in economic development can be viewed as a timely variation on the voluntary service theme. It could also be argued that public colleges and universities have a responsibility for economic development as part of the public trust through which state institutions are supported and that such involvement is a natural extension of a public college or university's basic function (Stauffer, 1986).

Missouri College and University Involvement in Economic Development Programs

Missouri's colleges and universities are responding to the challenge of expanding their involvement in economic development as programs of various types are currently operational on many public college and university campuses. A selected list of such programs include the following.

1. The Higher Education Applied Projects (HEAP) program, established by the Missouri General Assembly (1982) as part of the Missouri Research Assistance Act and currently administered by the Missouri Department of Economic Development, funds projects focused on applied research conducted through any higher education institution in Missouri except the University of Missouri. Applied projects are those which seek to "utilize, synthesize, or apply existing knowledge, information, or resources to the resolution of a specified problem, question, or issue." Past and/or current HEAP projects have been funded at Southwest Missouri State, Northwest Missouri State, Central Missouri State, Northeast Missouri State, Southeast Missouri State, Lincoln University, and Washington University in St. Louis.

2. The Higher Education Research Fund (also established through the Missouri Research Assistance Act) is administered by the University of Missouri Board of Curators for basic research conducted through the University of Missouri campuses, Washington University, and Saint Louis University. Since its inception the program has funded 193 projects securing $11 million in matching funds from private sources.

3. Four "innovation centers" initiated by the Missouri Corporation for Science and Technology and funded by the Department of Economic Development are currently operational. Three of these innovation centers are located on campuses of the University of Missouri System (Columbia, Kansas City, and Rolla), and one is located in St. Louis working in close collaboration with Washington University and Saint Louis University. Innovation centers provide low-cost physical space and shared administrative and clerical services as well as technical, managerial, financial and other assistance to new firms, with special emphasis given to the needs of firms in the advanced technology areas. As such, these centers serve as high-tech incubators for new business development.

4. Centers for Advanced Technology (CATs) exist on the University of Missouri-Kansas City and Rolla campuses as well as on the Washington University campus. The centers were established by the Missouri Corporation for Science and Technology to enable Missouri universities and industries to undertake cooperative research and development programs in technological areas identified as having significant potential for economic growth in Missouri. The centers conduct basic and applied research, product and process development, and commercial technology transfer.

5. Small Business Development Centers (SBDCs) currently operate on 10 public college or university campuses; University of Missouri-Columbia and Rolla campuses, Northwest, Northeast, Southwest, Southeast, and Central Missouri State University campuses, at Missouri Southern State College, and at Three Rivers and Mineral Area Community Colleges. Additional SBDCs are located at Rockhurst College, Saint Louis University, and within the Department of Economic Development in Jefferson City which operates an SBDC specializing in promoting the federal Small Business Innovation Research program and other Missouri high-tech development programs and serves as a liason between high-tech business development entrepreneurs and 11 federal agencies.

6. The Missouri Rural Innovation Institute (MRII) operates through the University of Missouri System Extension Service and provides leadership development and economic development expertise to rural communities throughout the state. The MRII was established with funds ($975,000 over three years) awarded by the Kellogg Foundation.

7. The University of Missouri System administers two research parks - the Missouri Research Park in the St. Louis area and the North Campus Research Park at the University of Missouri-Kansas City. Both research parks are under development and when fully operational will offer tenants access to university facilities and educational resources, including libraries, information processing, conference facilities, and professional staff and faculty. The St. Louis area facility will concentrate on attracting companies and organizations that can capitalize on the academic strengths of universities in the St. Louis area, which include such fields as agriculture, computer sciences, robotics, aerospace, medicine, biotechnology and engineering. The primary focus of the North Campus facility is to link the University of Missouri-Kansas City's research, teaching and public service goals with the industrial and business sectors consistent with the university's long-range plans of developing eminence in the areas of computer science, telecommunications and the life sciences.

8. In addition, many colleges, particularly community colleges, provide an extensive and diverse set of programs and offerings providing employee training and retraining. Such services are vital to fulfilling the needs of business and industry for skilled labor. In this regard, the crucial role community colleges have in human resource development is absolutely essential to the ability companies have to remain competitive in an international economy.

These various programs provide important vehicles for higher education participation in economic development. Expansion of relevant programs (e.g., SBDCs) to other campuses and more extensive participation of four-year colleges and universities in the HEAP program is certainly feasible. The establishment of campus-based centers for technology transfer or research like those at Central and Southwest Missouri State Universities can provide important linkages to area businesses and industries and expand both the research and service capacities of the institution.

The Crucial Role of Higher Education in Economic Development

The colleges and universities currently involved with the various programs obviously are making important contributions to the economic vitality of the state through their involvement in capacity building, technical assistance, research, technology transfer and new business development. As important as these new programs are to Missouri, President Bok of Harvard hastens to point out that the major long-term challenge to economic development "is not going to be solved merely by strengthening our research efforts, nor is it a narrow question of simply trying to help business improve productivity or discover new products." Bok's view of the problem of competitiveness, and America's waning performance in the international arena, is that it is a "signal that tells us that we need to revitalize the society, its corporate management, the effectiveness of government, the quality of education, the welfare and opportunities given to the poorest of its citizens" (1988, page 18).

Jim Mingle, executive director of the State Higher Education Executive Officers' Association, would agree with Bok and in a presentation on "Postsecondary Education's Contribution to the Economy" (1989), mentions how--

> ...as a society we firmly believe and want education to be the primary path of upward social and economic mobility. ...Our job as educators and policy makers is to figure out how to make the system work better so that belief can be realized. There is ample evidence that the system isn't working as well as it should for as many people as it should. Some institutions and programs have greater impact than others. To use the economists' term, some add more value than others.
>
> In my view, higher education plays a vital, even central role in economic development. But I view the nature of that role as one which is carried out primarily through individuals. The primary contact is between students and the institution, not between two corporate entities or between two sectors. The higher education/business partnership is clearly secondary to the higher education/student partnership.
>
> In short, the economic and social value to the state of better, smarter, more creative, more productive college graduates who are committed to the values we hold dear as a society, is potentially of extraordinary magnitude. (page 3)

In his concluding remarks Mingle notes that the connection between individual learning and economic development suggests three important priorities for higher education which

1. need to increase its success rate with the students it enrolls,

2. must reform its curriculum so it is relevant to the world of the 21st Century, and

3. should work to break down the barriers between levels of education that hinder student achievement -- barriers that stand between secondary and postsecondary and between levels of the postsecondary system (pages 3-5).

The Coordinating Board recognizes the importance of higher education to economic development.

It is clear that higher education has a crucial role to play within the context of an overall plan for economic development and revitalization of the economy. That role, however, is best filled by providing high quality instruction, research and public service and by monitoring higher education's performance in achieving the level of excellence demanded of it by students, parents, businesses and industries. In that regard, higher education can be an important part of the conversation in policy planning and program development for an efficient, effective and comprehensive economic development agenda but cannot be the sole discussant of the issues nor be viewed as the only solution.

The Missouri Coordinating Board for Higher Education has undertaken several projects and released several reports related to the importance of higher education to economic development and the crucial role of planning in the formulation of higher education-economic development policy. The Coordinating Board has assumed a proactive posture both in terms of strengthening the quality of higher education and in its role in economic development as reflected in the following study issues/reports that have either been completed, are on-going, or are scheduled for implementation:

- Statewide Higher Education Performance Indicators -- to provide an annual assessment of the state's system of higher education on twelve critical dimensions related to outcomes, resources, and contexts. The various public two- and four-year institutions are also developing institutional level performance indicators to provide annual assessments along these dimensions reflecting both a system-wide and institutional responsiveness to assessment and accountability.

- Regional Needs Assessments -- to designate areas of prior need for instructional services with the goal of increasing the participation rate of Missourians in postsecondary training and education which is a key factor underlying Missouri's future economic competitiveness and well-being.

- Missouri Manpower Needs -- to determine current and projected state manpower requirements for an educated and skilled workforce for Missouri businesses and industries to be competitive in the national and international economy and related implications for the delivery of postsecondary training and education. (CBHE report - "Manpower Trends and Issues: A National Perspective, A Missouri Context," 1989.)

- Minorities in Missouri Higher Education -- to provide an overview of the changing demographics and the need for increasing minority student and faculty recruitment and retention in the state's system of higher education. (CBHE report - "Challenges and Opportunities: Minorities in Missouri Higher Education," 1988.)

- Off-Campus and Out-of-District Instruction -- to determine more efficient and qualitatively effective ways of providing education and training opportunities to those who are unable to participate in on-campus offerings. (CBHE report - "The Invisible Campus: Off-campus and Out-of-district Instruction in Missouri, Fiscal Year 1988," 1989.)

In addition, other reports have been prepared by the Office of Social and Economic Data Analysis of the University of Missouri Extension Division, Confluence, Inc. of St. Louis, and the Hawthorne Foundation.

Results of these and future studies will prove valuable in addressing current and future educational resource and programmatic needs of the citizenry and of the state's system of higher education. These studies provide valuable information for the development of plans for strengthening the role of higher education in economic development and planning for the future economic vitality of the state.

The complexity of the issues and the scope of interests related to economic development may require that policy planning and program development for an efficient, effective, and comprehensive review of the future roles of higher education in Missouri economic development involve, through the leadership of the Department of Economic Development, the joint participation of representatives from the Missouri Corporation for Science and Technology, the Coordinating Board for Higher Education, the State Board of Education, Division of Employment Security, the Departments of Labor, Health and Social Services, elected officials, and business and industry. Through such collaborative effort among these appointed and elected boards and officials will Missouri achieve a coordinated planning, program and policy development environment for securing its economic future.

Collaboration among these and other state officials in assessing how the state's system of higher education can most effectively and efficiently support, in a coordinated fashion, the state's economic development agenda within the framework of the respective institutions' missions and approved institutional plans might well include further exploration and discussion of the following issues:

- coordinated statewide planning for human resource development involving the Coordinating Board for Higher Education and the State Board of Education with specific attention to issues related to strengthening the quality of our teachers, curricula, and issues related to the retention of all students in all levels of Missouri's system of education;

- the feasibility of establishing joint programs or consortia among institutions for applied research, technology transfer, and/or business development;

- the expansion of Small Business Development Centers to more campuses; and

- the development of policy initiatives to increase business and industry support of, and linkages with, colleges and universities.

Collaborative discussions of these and other emerging issues can provide the foundation for the development of coherent and integrated statewide policy initiatives for developing an education infrastructure able to respond to present and future demands of Missouri's economic development agenda.

Factors of Higher Education Related to Economic Development: Missouri and Competitor States

The Higher Education Context

Crucial to statewide planning for economic development is the recognition of the importance of the educational infrastructure to the overall economic vitality of the state. Frank Newman, president of the Education Commission of the States has suggested that:

> The nation's economic development is directly linked to a recognized dependence on higher education. No state--no nation--can afford to maintain second class institutions. In a world of growing economic competition and social complexity, it is the university to which the state turns for assistance (in *Choosing Quality: Reducing Conflict Between the State and the University*, 1987).

The quality of a state's education system is crucial to economic development.

The quality of a state's educational system is important not only with regard to the more direct relationships to economic development -- such as providing quality teachers, human resource development, basic and applied research, technology transfer, and stimulating existing and new business development -- but also through the "allocative ability" that education creates. Education enhances the ability of individuals to make informed choices, to better match skills with jobs, and to adjust to changes in the job market. Other important outcomes have been summarized by Bowen (1977) in his comprehensive review of the evidence relating to the benefits of a college education.

- A college education has a positive effect on citizenship, practical competence for family life, and personal health (which is obviously important to economic productivity);
- College graduates are more interested and informed about political and public affairs, are more likely to be registered voters, are more likely to vote, and are more active in community affairs;
- College graduates are more likely to be future-oriented with a stronger commitment to their children's education and welfare.

These outcomes are no less important to securing the state's economic future than are those more directly related to economic development activity--both are affected by the availability and quality of higher education.

Discussions of educational quality are often approached from different perspectives with dissimiliar, often implicit, definitions of excellence which can be difficult to operationalize. A summary of these differing perspectives and associated definitions of excellence has been offered by Morgan and Mitchell (1985) and is presented in Table 8. Approaching educational quality from these varying perspectives has the potential of creating dysfunctional dialog and can inhibit coordinated planning by those charged with making decisions about higher education institutions and systems. For example, higher educa-

perspective--as revealed in the Coordinating Board's Statewide Higher Education Performance Indicators. State legislators often view quality from productivity and political economy perspectives. College and university administrators might take a value-added or producer-consumer quality approach in their discussions of educational excellence. The faculty may view quality primarily from a content or value-added perspective. Individuals and groups representing business and industry would most likely approach quality from a political economy perspective. Awareness of these various perspectives by those charged with coordinated planning is necessary for effective communication and productive effort.

Ideally, consideration of the various perspectives on quality by the different individuals or groups charged with the task of coordinated planning would result in a more parsimonious definition of quality (and attendant indicators) thus providing for a more effective allocation of resources targeted toward improvement.

Table 8

Six Perspectives on Educational Excellence

Perspective	Short Definition	Representative Reports on Excellence
Political economy approach	Excellence is measured by how well schools and colleges support and enhance the political and economic strength of the nation.	Business-Higher Education Forum, "America's Competitive Challenge" Task Force on Education for Economic Growth, "Action for Excellence"
Productivity approach	Excellence is measured by how efficiently schools and colleges convert inputs into outputs.	National Science Board Commission on Precollege Education, "Educating Americans for the 21st Century"
Value-added approach	Excellence is measured by how well schools and colleges enhance individual development.	Southern Regional Education Board, "Meeting the Needs for Quality in the South"
Producer-consumer quality approach	Excellence is determined by the quality of producers (faculty) and consumers (students).	John Goodlad, "A Place Called School" Theodore Sizer, "Horace's Compromise"
Content approach	Excellence is judged by the quality and scope of the curriculum.	Mortimer Adler, "The Paideia Proposal" John Goodlad, "A Place Called School" The College Board, "Academic Preparation for College"
Eclectic approach	Excellence is evaluated on a variety of dimensions, including efficiency, effectiveness, and characteristics of participants.	Ernest Boyer, "High School: A Report on Secondary National Commission on Excellence in Education, "A Nation at Risk"

Source: Morgan, Anthony W., and Brad L. Mitchell. 1985. "The Quest for Excellence: Underlying Policy Issues." Higher Education: Handbook of Theory and Research, vol. 1, New York: Agathon Press.

Higher Education Research Capacity and Economic Development

An additional context for assessing institutional and system quality, and one having an important bearing on economic development, is research. The research capacity of a state's higher education system (as determined by federal R&D funds acquired) has been

found to be related to increases in the number of business establishments as well as to growth in aggregate income and to increases in per capita income via the production of growth in higher quality jobs (Jones and Vedlitz, 1988). Also, in a 1982 study of factors affecting high technology business regional site location decisions prepared for the Joint Economic Committeee of the U.S. Congress, academic institutions ranked fourth among twelve determinants related to plant relocation decisions. While the research capacity of academic institutions per se was not specifically noted, the reputation of a state's colleges and universities, primarily its major research universities, is heavily dependent not only upon admissions standards, the strength of their various programs, and the quality of their matriculating students, but also upon their perceived strength as research institutions. Other major factors affecting site location decisions were the availability of skilled technical and professional labor, labor costs, and tax climate/structure (Premus, 1982).

Higher education system research capacity is important for attracting new business expansion to the state, and also for enhancing the system's capacity for technology transfer and for stimulating growth in existing businesses that seek to develop a competitive edge in manufacturing and new product development. States are keenly competitive as they vie for capturing an increasing share of international and national business expansion. Missouri's major regional competitor states in this arena (as identified by the Missouri Department of Economic Development) are Arkansas, Iowa, Illinois, Indiana, Kansas, Kentucky, Minnesota, Nebraska, Oklahoma, and Tennessee. Missouri's position relative to its competitor states on research capacity and other factors related to economic development provides a means for assessing the state's comparative strengths and weaknesses in seeking to formulate policy and implement plans for future economic development efforts.

Research Funding and Missouri's Higher Education System

One useful context for assessing state higher education system research capacity is by considering expenditures for research and development at doctorate-granting institutions. A summary of research and development expenditures for Missouri and its competitor states for the period 1980-1987 is presented in Table 9. The data show that R&D expenditures at Missouri's doctoral granting institutions (both public and private) have grown at a yearly rate of slightly over 9 percent (the national average is 10.45 percent) and that expenditures at Missouri institutions have remained, on average, about 30 percent higher than the average of doctoral granting institutions of our competitor states. Only two of the competitor states (Illinois and Minnesota) have consistently shown larger R&D expenditures than Missouri. Additional comparisons are shown for Missouri and what may be considered as "aspiration states." These states (Texas, North Carolina, Michigan, and Ohio) might be viewed as those providing a level of aspiration for select features of Missouri long-range economic and higher education development efforts. Comparatively, Missouri's R&D expenditures have remained, on average, about 52 percent less than the average of these four aspiration states.

Table 9

R&D Expenditures at Doctoral Granting Public and Independent Institutions: Missouri and Competitor States, FY 1980-87 (in thousands)

	1980	1981	1982	1983	1984	1985	1986	1987	Average Rate of Change 1980-87
U.S. Tot.	5,960,505	6,733,086	7,207,151	7,761,865	8,484,591	9,550,880	10,769,068	11,930,997	10.45%
MO	112,738	123,023	129,450	135,668	150,526	161,450	186,836	207,020	9.13%
AR	26,637	26,353	32,349	27,315	26,616	30,051	35,379	35,529	4.95%
IA	94,582	102,992	110,710	119,646	119,257	132,222	146,269	157,482	7.61%
IL	238,200	265,282	284,980	312,037	357,285	392,793	438,991	498,221	11.14%
IN	101,426	121,615	123,329	133,671	144,994	158,983	176,374	188,086	9.34%
KS	49,398	55,336	56,411	63,655	71,348	80,144	90,579	93,931	9.71%
KY	36,502	42,275	46,201	49,498	52,647	53,790	68,552	78,008	11.72%
MN	119,065	133,057	146,466	151,441	158,223	173,322	201,743	222,381	9.41%
NE	42,357	47,734	53,018	53,753	53,801	60,612	69,765	71,730	7.97%
OK	48,081	67,923	71,173	87,072	91,386	96,407	88,876	99,116	11.79%
TN	61,358	70,264	67,178	71,873	78,881	107,280	123,668	144,144	13.53%
Competitor State Avg.	81,761	93,283	99,182	106,996	115,444	128,560	144,020	158,863	9.98%
Mo % above/ below Avg	37.89%	31.88%	30.52%	26.80%	30.39%	25.58%	29.73%	30.31%	
TX*	346,215	415,788	454,235	511,402	557,508	632,891	723,073	810,993	12.98%
NC*	128,129	154,033	164,706	180,364	208,582	254,370	281,929	313,819	13.77%
MI*	216,699	235,750	226,172	249,580	283,708	301,391	342,031	396,786	9.21%
OH*	181,676	199,994	201,998	209,839	231,339	261,447	287,670	328,772	8.94%
Average*	218,180	251,391	261,778	287,796	320,284	362,525	408,676	462,593	11.38%
Mo % above/ below Avg	-48.33%	-51.06%	-50.55%	-52.86%	-53.00%	-55.47%	-54.28%	-55.25%	

Source: National Science Foundation, Division of Sciences Resources Studies, 1989.
* States providing a level of aspiration for Missouri economic development efforts.

Federally Financed R&D Expenditures: Missouri and Competitor States

The amounts of Missouri and competitor state R&D expenditures that were federally financed for the period 1980-1987 are shown in Table 10. Federally financed R&D expenditures reveal an institution's or system's ability to secure research funding from the various federal sources and can reflect, to some extent, the perceived quality of research programs/institutions. The data show an average annual increase of 7 percent in expenditures for Missouri's doctoral granting institutions with a national average increase of 8.75 percent. Federally financed R&D expenditures at Missouri's public and private institutions have, on average, been 42 percent higher than the average expenditures of its competitor states. Illinois is the only competitor state that has consistently outperformed Missouri in this regard. Compared to the aspiration states, Missouri's annual rate of increase has been about 2 percent less and expenditures for R&D have averaged about 51 percent below aspiration state averages.

Although Missouri's federally financed R&D expenditures have consistently been significantly higher than all but one of our competitor states, the major portion of these expenditures for research and development at the universities can be accounted for by the private institutions in the state. Of the $113.458 million in federally financed R&D expenditures for FY 1987, the University of Missouri system campuses accounted for $26.021 million (23 percent). Washington University in St. Louis received $77.757 million (over 68 percent).

Sources of Higher Education R&D Support: Missouri and Competitor States

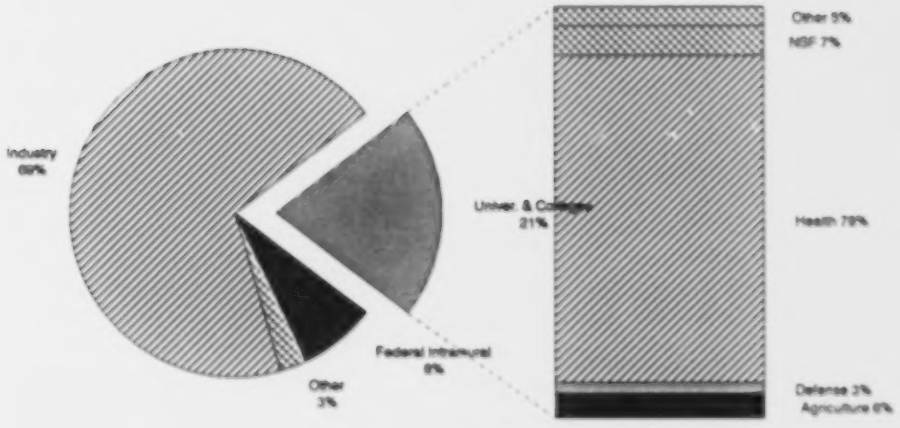
Relative contributions to R&D expenditures at doctoral granting institutions by various sources for Missouri and competitor states for FY 1987 are shown in Table 11. In 1987, Missouri's R&D expenditures were $207.02 million which was about 30 percent higher than the average of our competitor states. The distribution of these funds by source shows that the federal government provided $113.458 million (55 percent); state and local governments, $11.779 million (6 percent); industry, $19.122 million (9 percent); and institutional funds accounted for $50.268 million (24 percent). All other sources accounted for $12.393 million (6 percent). Further inspection of the dollar amounts by sources shows that Missouri's expenditures from federal sources were about 40 percent higher than the average of our competitor states and that expenditures from industry and institutional fund sources were, respectively, 95 and 26 percent higher which speaks well of industry and institutional support for Missouri's research and development effort.

The distribution of federal obligations (grants, contracts, etc.) for research and development awarded to Missouri and competitor states' businesses, industries, agencies and colleges and universities by various agencies for FY 1987 is shown in Table 12. Missouri ranked 19th in the nation, obtaining $614.622 million, which was more than twice the average of the competitor states. Over 90 percent of Missouri's funds, however, were received from only two sources; the Department of Defense (74 percent), and the Department of Health and Human Services (19 percent). Research and development obligations from the Department of Agriculture accounted for only 2 percent of Missouri's total and were 13 percent less than the average for the competitor states. Obligations

for R&D from the Departments of Energy and Transportation, and from the Environmental Protection Agency, NASA, and the National Science Foundation were significantly less than those of the competitor states. Even though total R&D obligations to Missouri are substantially larger, the competitor states show much more diversification in their acquisition of federal funds for research and development while Missouri is heavily dependent upon defense-related grants and contracts for much of its R&D effort.

Figure 14

FEDERAL OBLIGATIONS FOR RESEARCH
AND DEVELOPMENT IN MISSOURI FY 1987
(Total = $614.6 million)



Source: National Science Foundation

The distribution of these federal fund obligations within Missouri can be seen in Figure 14. The bulk of the $614.6 million in federal R&D fund obligations was awarded to industry (69 percent). Universities and colleges acquired 21 percent or about $128 million with 79 percent of these funds (approximately $102 million) coming from the Department of Health and Human Services. Of this $128 million, the University of Missouri system campuses received $28.194 million (22 percent) with the remainder going to private universities in the state. Federal R&D fund obligations to Missouri's colleges and universities from the Department of Agriculture were approximately $7.74 million; from the National Science Foundation, $9.03 million; from the Department of Defense, $3.87 million; and from various other agencies, about $6.45 million.

Table 10

Federally Financed R&D Expenditures at Doctoral Granting Institutions: Missouri and Competitor States, FY 1980-87 (in thousands)

	1980	1981	1982	1983	1984	1985	1986	1987	Average Rate of Change 1980-87
U.S. Tot.	4,029,241	4,486,721	4,684,945	4,901,828	5,330,885	5,963,998	6,603,386	7,230,217	8.75%
MO	70,926	77,670	81,047	81,146	86,630	92,498	102,725	113,458	7.00%
AR	7,177	7,122	10,759	11,233	10,004	11,551	12,385	12,257	9.35%
IA	50,505	54,267	56,940	61,524	62,238	64,106	69,892	76,862	6.23%
IL	168,213	184,733	190,412	204,722	223,090	240,113	258,845	293,929	8.34%
IN	68,435	80,341	81,978	83,705	86,470	97,004	106,979	111,413	7.35%
KS	25,694	29,465	24,659	26,340	29,156	31,088	35,552	37,386	6.00%
KY	17,277	17,994	18,959	18,080	19,317	19,241	24,963	30,778	9.19%
MN	68,463	77,850	83,044	79,637	79,489	87,776	100,308	109,003	7.07%
NE	17,098	17,115	18,683	17,133	19,702	24,671	28,495	32,934	10.32%
OK	24,005	22,557	25,405	25,204	25,965	30,420	24,304	25,908	1.78%
TN	42,218	49,306	45,650	45,023	49,695	66,183	74,096	80,820	10.37%
Competitor State Avg.	48,909	54,075	55,649	57,260	60,513	67,215	73,582	81,129	7.55%
MO % above/ below Avg.	45.02%	43.63%	45.64%	41.71%	43.16%	37.61%	39.61%	39.85%	
TX*	211,847	234,316	241,080	255,721	275,001	329,274	368,797	403,298	9.74%
NC*	88,960	104,954	116,145	124,260	134,176	156,591	177,301	195,177	11.95%
MI*	127,767	136,249	131,389	145,751	165,728	175,312	189,070	208,017	7.34%
OH*	117,786	131,442	133,077	131,775	145,823	160,961	177,417	193,061	7.42%
Average*	136,590	151,740	155,423	164,377	180,182	205,535	228,146	249,888	9.07%
MO % above/ below Avg.	-48.07%	-48.81%	-47.85%	-50.63%	-51.92%	-55.00%	-54.97%	-54.60%	

Source: National Science Foundation, Division of Science Resources Studies, 1989.
* States providing a level of aspiration for Missouri economic development efforts.
Note: Of the $113.458 million in Federal R & D funds expended by Missouri doctoral granting institutions in FY 1987, Washington University accounted for $77.757 million and the University of Missouri System (all campuses) accounted for $26.021 million. Other institutions accounted for the remaining $9.68 million.

Table 11

R&D Expenditures at Doctoral Granting Institutions by Source: Missouri and Competitor States, FY 1987 (in thousands)

	Total	Federal Government	State and Local Governments	Industry	Institutional Funds	All Other Sources
U.S.	11,930,997	7,230,217	1,003,449	764,008	2,109,547	823,696
MO	207,020	113,458	11,779	19,122	50,268	12,393
AR	35,529	12,257	9,352	2,829	8,028	3,063
IA	157,482	76,862	16,651	6,212	49,668	8,089
IL	498,221	293,929	30,610	23,791	117,826	32,065
IN	188,086	111,413	15,772	17,203	37,627	6,071
KS	93,931	37,386	20,031	5,433	27,607	3,474
KY	78,008	30,778	10,841	6,715	26,545	3,129
MN	222,381	109,003	37,287	11,056	39,371	25,664
NE	71,730	32,934	16,074	4,185	14,976	3,561
OK	99,116	25,908	3,380	6,738	57,620	5,470
TN	144,144	80,820	25,789	13,792	19,232	4,511
Competitor State Avg.	158,863	81,129	18,579	9,795	39,850	9,510
MO % above/ below Avg.	30.31%	39.85%	-36.60%	95.21%	26.14%	30.32%
TX*	810,993	403,298	89,468	46,295	172,935	98,997
NC*	313,819	195,177	54,897	23,825	25,757	14,163
MI*	396,786	208,017	30,343	25,072	103,788	29,566
OH*	328,772	193,061	34,903	22,360	46,924	31,524
Average*	462,593	249,888	52,403	29,388	87,351	43,563
MO % above/ below Avg.	-55.25%	-54.60%	-77.52%	-34.93%	-42.45%	-71.55%

Source: National Science Foundation, Division of Science Resources Studies, 1989.
* States providing a level of aspiration for Missouri economic development efforts.
Note: Of the $113.458 million in Federal R & D funds expended by Missouri doctoral granting institutions, Washington University accounted for $77.757 million and the University of Missouri system (all camupuses) accounted for $26.021 million. Other institutions accounted for the remaining $9.68 million.

Table 12

Federal Obligations for Research and Development, by Agency: Missouri and Competitor States, FY 1987 (in thousands)

	Total	Agriculture	Commerce	Defense	Energy	Health & Human Ser	Interior	Transportation	EPA	NASA	NSF
U.S.	54,065,662	940,467	402,149	35,083,844	4,754,118	6,569,654	403,520	324,342	348,244	3,770,248	1,469,076
MO (19)	614,622	12,329	685	455,725	2,201	115,510	9,843	1,053	499	5,631	11,146
AR (43)	52,343	7,014	NA	12,327	390	26,120	3291	586	243	441	1,911
IA (33)	162,127	25,294	168	48,702	16,786	54,173	2,484	450	900	6,922	6,248
IL (16)	826,964	30,736	863	227,580	288,960	183,449	3,021	3,313	3,163	14,015	71,864
IN (28)	339,429	9,349	122	213,816	15,614	52,247	2,551	4,458	1,235	5,735	34,302
KS (39)	94,059	9,428	15	53,191	1,646	19,552	2,775	254	798	2,519	3,881
KY (42)	62,163	9,595	26	11,530	1,407	31,366	2,487	1,032	946	792	2,982
MN (21)	506,464	16,908	355	310,846	4,778	125,313	11,024	1,447	6,809	11,960	17,024
NE (44)	48,922	14,763	235	10,817	492	14,455	2,654	333	60	853	4,260
OK (38)	101,778	12,253	3,113	29,513	13,523	16,100	3,225	5,368	10,360	3,795	4,528
TN (17)	731,962	6,702	720	357,107	226,851	90,210	2,661	434	20,054	16,611	10,612
Compet. State Average	292,621	14,204	562	127,543	57,045	61,299	3,617	1,768	4,457	6,364	15,761
MO % above/ below Avg.	110.04%	-13.20%	21.89%	257.31%	-96.14%	88.44%	172.11%	-40.44%	-88.80%	-11.52%	-29.28%
Avg. Percent Distribution Compet. States		10.74%	0.45%	38.05%	10.09%	27.46%	2.70%	1.13%	1.85%	2.26%	5.32%
MO Percent Distribution		2.01%	0.11%	74.15%	0.36%	18.79%	1.60%	0.17%	0.08%	0.92%	1.81%
TX (7)*	2,261,080	41,966	987	1,534,447	17,687	250,430	4,592	11,216	15,675	345,510	38,570
NC (20)*	583,706	24,683	754	190,912	6,123	250,868	3,061	20,373	54,449	6,886	25,597
MI (22)*	463,392	14,488	4,772	200,635	27,947	148,920	5,141	2,065	6,068	13,803	39,553
OH (11)*	1,863,723	13,290	222	1,347,742	55,935	151,621	2,601	7,050	32,009	230,848	22,405
Average*	1,292,975	23,607	1,684	818,434	26,923	200,460	3,849	10,176	27,050	149,262	31,531
MO % above/ below Avg.	-52.46%	-47.77%	-59.32%	-44.32%	-91.82%	-42.38%	155.75%	-89.65%	-98.16%	-96.23%	-64.65%
Avg. Percent Distribution	2.48%	0.30%	54.05%	2.72%	23.58%	0.49%	1.20%	3.26%	7.96%	3.96%	

Source: National Science Foundation, Division of Science Resources Studies, 1989.
* States providing a level of aspiration for Missouri economic development efforts.
Note: Numbers in parentheses indicate national rank relative to total federal R & D obligations.

Other Comparative Features of Higher Education: Missouri and Competitor States

Research capacity and performance, while providing a useful measure for describing higher education systems and institutions, is not the only factor to be used in characterizing the contribution of higher education to a state's economic vitality. The development of human resources is the sine qua non of education and economic development.

Changes in enrollments and degree completions, reflect, to a large extent, a higher education system's ability to provide access to its citizenry. Percent changes in enrollments and degree completions for the period 1975 to 1985 for Missouri and competitor states are shown in Table 13. The data show that Missouri's public sector postsecondary enrollments in both two- and four-year institutions have not kept pace with the percentage increases in enrollments of the competitor states. The area of major difference is with enrollment in two-year institutions where the average 1975-1985 increase for the competitor states was almost 64 percent. This may, however, merely reflect rapid increases in the number of new community colleges established in the competitor states (which is also suggested by their percent change in associate degree completions). Missouri, with a stable history of providing community college access, shows a healthy 41 percent increase in associate degree completions and shows higher than average increases in bachelor's and master's degrees conferred. What is of some concern, however, is Missouri's almost 20 percent reported decrease in the number of doctoral degrees awarded between 1975-85 as compared to the national and competitor states' averages of about a 3 percent decline. However, it should be noted that within Missouri's public institution sector the percent change in doctoral and first professional degrees awarded between 1981-88 increased 3 percent to 986 but remains about 8 percent less than the 1,070 degrees conferred in 1984. Since over 20 percent of the nation's faculty are over age 55 it is imperative that the flow of Missouri's ablest students through the education "pipeline" be increased to provide for the current and future faculty needs of the state and nation.

A commitment to improving educational quality is necessary for securing the long-term vitality of the state's economy.

While stimulating a state's overall economic development necessarily involves a multifaceted approach to address the numerous factors associated with a healthy and growing economy, enhancing the recognized quality of the educational system infrastructure is a true measure of a state's commitment to the demonstrable relationship between education and economic development. A commitment to improving educational quality is a necessary antecedent for securing the long-term vitality of the state's economy.

The Coordinating Board for Higher Education has initiated many new studies to aid in further policy development to support its public policy goals of quality, efficiency, and effectiveness and to ensure that Missouri's system of higher education remains responsive to the new demands for an educated work force able to compete in a technological society and an increasingly international economy. Missouri's success in meeting the challenge of these new demands and securing its economic future will require ensuring that the state's citizens receive the highest quality of education possible by providing the very best in teachers, programs, and equipment. To do less, is to risk Missouri's future.

Table 13

Percent Change in Select Features of Postsecondary Education: Missouri and Competitor States, Fall 1975 to Fall 1985

						Degrees Conferred			
Enrollment	Total Enrollment	Total FTE Enrollment	Public 4 yr. Enrollment	Public 2 yr. Enrollment	Private 4 yr. Enrollment	Associate	Bachelor's	Master's	Doctorates
US Total	9.5%	5.5%	4.2%	11.3%	13.1%	26.2%	6.1%	-2.1%	-3.3%
MO	8.1%	0.3%	5.9%	8.4%	10.1%	41.4%	8.7%	11.7%	-19.6%
AR	18.9%	14.9%	13.2%	43.9%	3.4%	87.5%	2.2%	21.5%	22.9%
IA	25.7%	19.0%	27.9%	37.9%	12.6%	61.0%	13.3%	10.8%	1.3%
IL	16.2%	7.0%	-3.3%	32.8%	10.6%	20.3%	4.2%	-0.3%	-4.9%
IN	17.2%	13.1%	9.3%	151.9%	-2.9%	129.1%	7.8%	-31.5%	-21.4%
KS	17.0%	4.5%	4.8%	56.2%	11.7%	27.3%	-0.2%	-2.0%	1.8%
KY	13.2%	9.3%	-0.9%	36.9%	13.3%	103.2%	-3.6%	-24.3%	1.6%
MN	19.7%	15.5%	6.3%	61.4%	23.6%	27.8%	12.2%	19.3%	-2.0%
NE	30.9%	17.1%	12.6%	112.2%	21.5%	80.4%	-0.6%	10.0%	-14.4%
OK	15.4%	10.7%	3.3%	55.1%	0.6%	30.6%	-1.5%	-3.1%	-18.9%
TN	7.4%	3.9%	-6.5%	50.1%	1.8%	95.5%	-3.4%	-12.2%	3.3%
Competitor State Avg.	18.2%	11.5%	6.7%	63.8%	9.6%	66.3%	3.0%	-1.2%	-3.1%
TX*	23.3%	15.5%	17.5%	35.1%	11.3%	44.8%	12.5%	24.2%	19.3%
NC*	30.0%	15.1%	15.7%	53.7%	22.4%	34.3%	6.8%	18.1%	-15.5%
MI*	2.2%	-2.5%	-5.3%	5.3%	14.4%	40.5%	3.6%	-20.7%	-23.0%
OH*	18.0%	11.3%	9.9%	18.9%	4.4%	52.9%	-5.5%	3.1%	-7.7%
Average*	18.4%	9.9%	9.5%	28.3%	13.1%	43.1%	4.4%	2.5%	-2.7%

Source: "Historical Trends: State Education Facts 1975 to 1985." National Center for Education Statistics, September 1988.
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